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INDICE

THE GEOGRAPHY OF AGEING, CAUSES, EFFECTS AND … FREE REFLECTIONS

Gian Carlo Blangiardo

Abstract. According to the most recent forecasts, the current 14 million over-65s in Italy could increase by another 5 million in the next twenty years. Even considering further gains in survival, with the possible moving forward of the thresholds for access to old age, the absolute growth in the number of elderly people would persist until mid-century, even if in terms of percentage the hypothetical (and justifiable) change in the definition of "who is elderly" would lead to a strong deflation of the intensity of the so-called "demographic aging".
At the basis of this phenomenon, however it is measured, there are three factors: the first is the rapid and intense birth rate decline, which deprives the country of significant flows of new youth and narrows the age pyramid from the bottom; the second concerns the increased ability to survive until old age and the third refers to an age structure which, powered by the very numerous contingents of births in last decades, presents itself with a strong component of subjects of "mature" age, destined to soon give rise to impressive inflows into the universe of the elderly. As for the effects of demographic aging on the Italian population, the undoubtedly most problematic aspects refer to its impact on two fundamental areas of society and the welfare system: healthcare and pensions.
Finally, it should be highlighted that, as a result of the transformations in terms of size and age structure, in three decades the Italian population is facing a loss of future perspective which will overall be equal to 415 million years of life (on average 13.8 million lost every year) and which will also manifest itself clearly at a per capita level: from the 38.4 years of expected life for each resident in 2023 to the 34.6 that on average will be attributed to those in 2053.

1. Who are the “elders”?

The Italian volume of the Multilingual Demographic Dictionary, with which at the end of the 1950s Bernardo Colombo made an important and useful working tool available to scholars, defined old as " [...] those who have entered senile age, or old age, that coincide, conventionally, with the age of retirement (usually 60 or 65 years old" (Colombo, 1959, p.45). At that time the life expectancy of a sixty-five years old, according to the mortality tables 1960-62 of the National Statistical Institute (ISTAT), was 13.4 years for males and 15.3 for females. Since then, more than sixty

years have passed and the residual expected life at the 65th birthday has risen to 18.9 and 21.9 years, respectively for males and females, but the statistical limit of senile age has not undergone any modification, despite the constant lengthening of what is formally the season of senility.

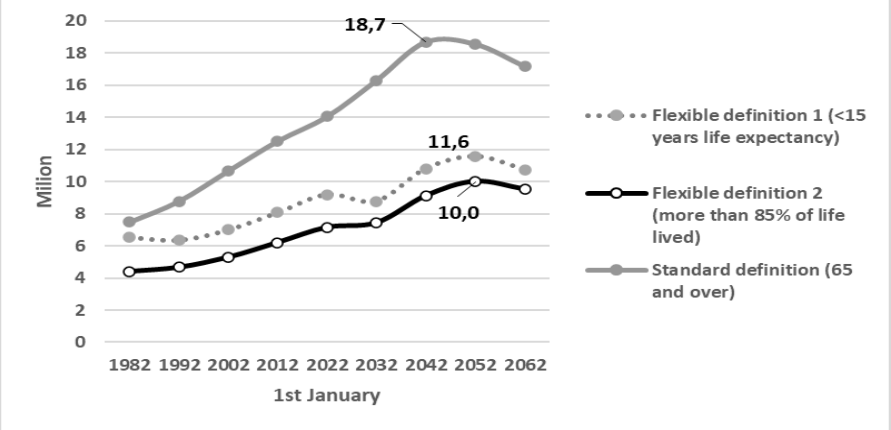
However, it should be remembered that an interesting proposal to make "mobile" the threshold of access to the elderly, to take into account the achievements in terms of lifespan, had been formulated almost half a century ago. The idea consisted of replacing the classic definition of elderly person as "someone who has lived for a certain number of years", with the more elastic one which considers old "someone who still has to live for no more than a certain number of years". (Rayder, 1975; Di Comite, 1977). Today, for example, if fifteen years were adopted as the residual life interval to mark the transition to the elderly, the age limit would be between 71 and 72 years - measured without distinction of gender - and the elderly on 1 January 2023 there would be 9.3 million, 15.7% of the total, instead of the 14.2 million over-65s (24%).

Alternatively, one could also propose that, instead of referring to a predetermined number of years of life expectancy, the age of entry into the universe of the elderly could be defined as that in which a predetermined fraction of the duration of life has been consumed. For example: an elderly person is "someone who already spent at least 85% of their existence between years lived and residual years expected on average". With that definition and according to the survival levels of 2022 - again without distinction of gender - the age threshold of elderly would be between 74 and 75 years and the corresponding number of elderly people in Italy on 1 January 2023 would drop to 7.3 million: 12.3% of the total residents.

Whatever the definitive approach with which to certify the elderly component, it must be remarked that the phenomenon of aging in our country manifests itself with a growing dynamic that comes from afar and which is oriented to continue, with even greater intensity, for at least another 3-4 decades. According to the most recent forecasts (ISTAT, 2023a) the number of over-65s could increase by another 5 million in the next twenty years and even taking different approaches and survival gains into account - which would influence the two "flexible" definitions - the absolute growth in the number of elderly people would persist until mid-century[1].

[1]The hypothetical mortality table for estimating survival expectations after 2022 was appropriately reconstructed on the basis of the life expectancy values adopted in the ISTAT forecasts for 2023 (www.demo.istat.it).

Figure 1 – *Elderly residents according to different definitions. Italy 1982-2062 (absolute values).*

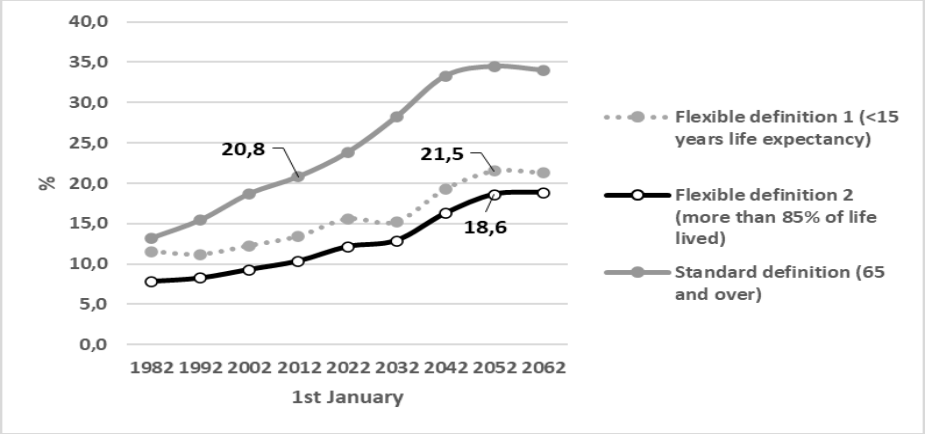


Source: 0wn processing in ISTAT data

The influence of the different definitional approach appears even more evident when the share of elderly people compared to the total residents is considered. While forty years ago the differences were relatively small and this percentage could vary from a minimum of 7.8%, adopting what we proposed as the second flexible definition, to a maximum of 13.2%, applying the "standard" concept of old people aged 65 and over, in 2022 the gap between the extremes has grown to around twelve percentage points (12.1% vs. 23.8%) and in next forty years it could stand at fifteen points.

In fact, if we accept that the phenomenon of demographic aging consists - as written in the manuals - in the growth of the share of the elderly population, we must also take into account that a hypothetical (and justifiable) change of definition in the thresholds of entry into the elderly collective can lead to a significant deflation of the intensity of aging itself. It is no coincidence that the maximum values that would be encountered in the middle of this century when measuring the phenomenon with the "flexible" definitional approach (around 20% of elderly people in both cases of flexibility) propose values which, in the "standard" definition of elderly people as over sixty-five, have already been observed ten years ago (20.8% in 2012).

Figure 2 – *Elderly residents according to different definitions. Italy 1982-2062 (%).*



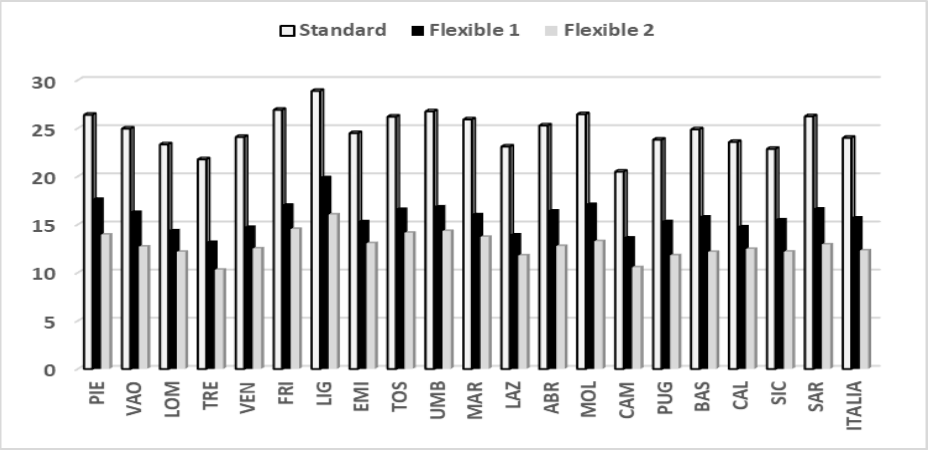
Source: Own processing in ISTAT data

2. Aging in the territories

By reporting the logic of the three different definitional approaches in territorial detail, the geography of aging in the Italian regions offers interesting differential aspects. While the top five regions in terms of share of people aged over sixty-five as of 1 January 2023 (in order: Liguria, Friuli V.G., Umbria, Molise and Piedmont) remain at the top - albeit with some permutations - even with the two "flexible" definitions, the change in thresholds reduces the extent of aging strongly and almost everywhere. Moving from the "standard" definition to the "flexible1", all regions benefit from a reduction in the share of elderly people of around nine percentage points, with the sole exception of Sicily and Campania where the gain is around seven points. The benefit is much greater if the comparison shifts to the "flexible2" definition. Molise and Sardinia gain more than thirteen percentage points, while all the other regions see a reduction in the share in the order of 11-12 points, except for Campania (-9.9 points).

In relative terms, in the transition from the "standard" to the "flexible1" definition, advance in the regional aging ranking - drawn up in decreasing order: from highest to least intense - Sicily (which rises by 6 positions) and Piedmont (+ 3), while the most evident decline is attributed to Veneto (-3 positions). If, however, the transition is pushed to "flexible2", it is still Sicily, with Emilia Romagna, that rise in the ranking (both by 4 positions), while Basilicata drops significantly (-5).

Figure 3 – *Percentage of elderly people in the Italia Regions according to different definitions at 1 January 2023.*

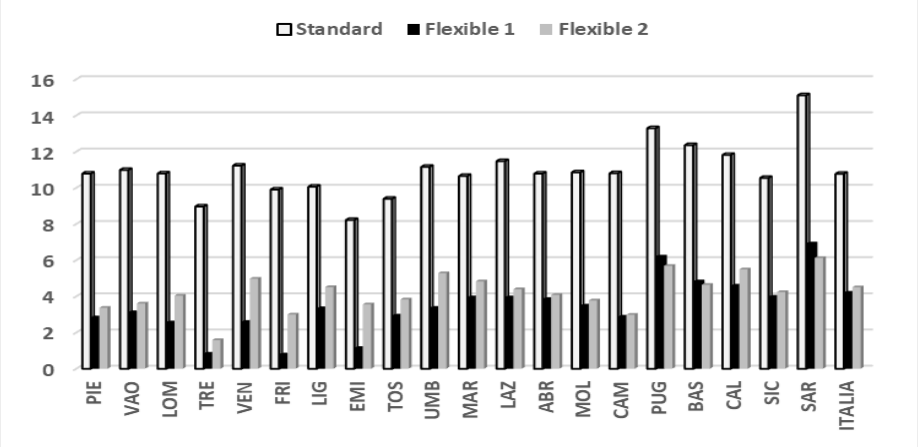


Source: Own processing in ISTAT data

Even over time, the aging process of the territories is affected in a differentiated way by the definitional variations. Between 1982 and 2023, according to the standard definition almost everywhere we arrive at a double-digit level of growth in aging, but the presence of people over sixty-five ranges between a maximum increase of 15.1 percentage points in Sardinia and a minimum that falls below ten points o in four regions: Friuli V.G. (+9.9), Tuscany (+9.4), Trentino A.A (+9) and Emilia Romagna (+8.2).

However, if the temporal comparison is carried out by adopting the two flexible definitions, the intensity of growth appears strongly attenuated almost everywhere. Sardinia is still the region that marks the highest increase in the share of elderly people, but with the "flexible1" definition this increase is 6.9 percentage points and drops to 6.1 with the "flexible2" definition. In general, the increases are in the order of 4-5 percentage points for almost all regions in correspondence with both definitional approaches, with the most moderate values in Trentino A.A., Friuli V.G. and Emilia Romagna.

Figure 4 – *Change in the share of elderly people in the Italian Regions according to different definitions between 1 January 1982 and 1 January 2023 (percentage points of change).*



Source: Own processing in ISTAT data

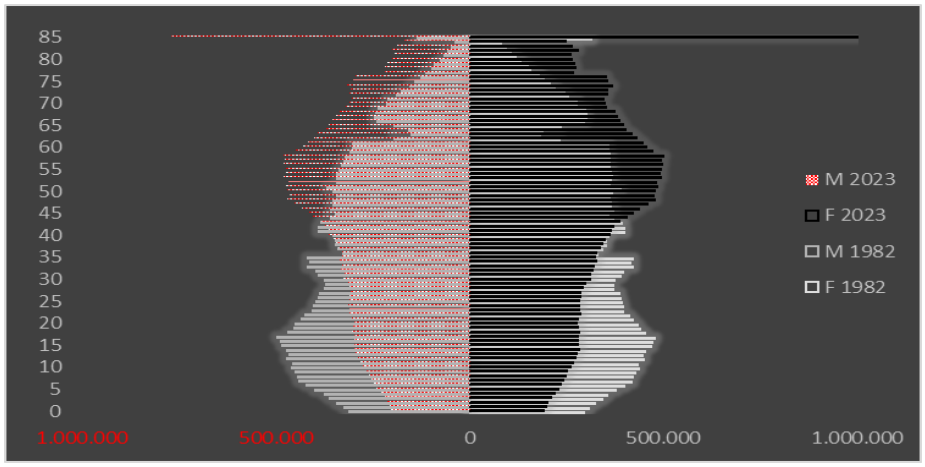
3. Causes and effects

Anyhow the demographic aging is measured, three determining factors are at the basis of what we have experienced until today and we will experience in the next 3-4 decades. The first is the rapid and intense birth rate decline which, by depriving the country of significant inflows of new youth, narrows the age pyramid from the bottom. The second and third can be said to be two factors that interact and must be read in combination. One refers to the growing ability to survive until old age - a meritorious result of the victory over early mortality - which contributes and will favor even more in the future the transition into the senile groups located at the top of the pyramid. The other factor is an age structure which, powered by the very numerous contingents of births in last decades, today it presents itself with a strong component of subjects of "mature" age, highly destined to survive and give rise to impressive flows entering the universe of the elderly.

With these premises, the fact that over the years the age pyramid of the Italian population has progressively lost its natural triangle shape to increasingly transform into a sort of mushroom can be quickly explained recalling a few simple data. The 40 generations that fed the lower part of the age pyramid on 1 January 1982 came from 35.6 million born between 1942 and 1981, while the corresponding contingent registered on 1 January 2023 can only count on the 21.2 million born between 1983 and 2022: almost 15 million births less (-40%). Let’s then keep in mind how the

survival conditions that lead to senile age have changed over time. For example in 1982 - according to the mortality tables of the time - the probability of reaching the age of 70 for a male was 63%, while in 2022 it reached 84%; and for females we went even higher (91%). It is therefore not surprising to expect that, even in perspective, the wave due to the baby-boom generations of the 1960s - now roughly in their sixties - will manifest itself with a certain vehemence in the immediate future. The corresponding peak just above the middle in the age pyramid of 2023 will progressively rise to the higher levels, so that in less than a couple of decades the most frequent age group in the Italian population will be centered on 75 years.

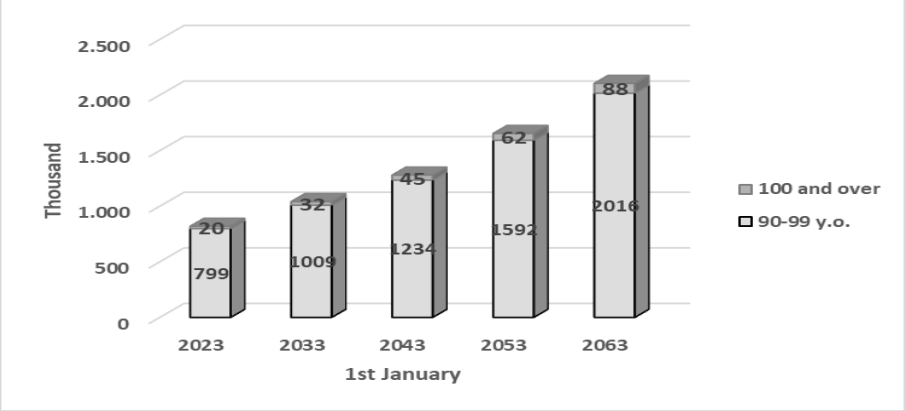
Figure 5 – *Age pyramid of the Italian population at 1 January 1982 and 2023 (absolute values).*



Source: 0wn processing in ISTAT data

Moving from the causes to the effects of demographic aging in the Italian population, the most evident and problematic aspects refer to its impact on two fundamental areas of society and the welfare system: healthcare and social security. On the first point, little data is enough to outline scenarios that suggest potentially serious critical issues. The just over 800 thousand over ninety years old population registered on 1 January 2023, of which around 20 thousand over centenarians, are destined to increase by 56% over the space of twenty years, to reach over two million in forty years (+157 %). The strong challenge for the health system will be, precisely, that of being able to guarantee to a population exposed to the fragility of old age which increases exponentially all the necessary and dutiful conditions of assistance and care, to ensure that none must suffer dangerous declines in the quality of life.

Figure 6 – *Population aged over ninety. Italy 1 January 2023-2063 (values in thousands).*



Source: Own processing in ISTAT data

Regarding the issue of social security and the sustainability of the pension system, forecasts for the next decades indicate a persistent growth in the ratio between the number of people of retirement age and that of potential workers, the so called "elderly dependency ratio (EDR)"

Assuming the limits of active age as the 20th and 67th birthdays, the indicator

$$EDR = 100\ Population_{67+}/Population_{20\text{-}66}$$

would grow from the current over one pensioner for every three workers (35.2% in 2023) to around six every ten over thirty years (60.6% in 2053).

This is not at all indifferent to the balance of the pension account, since it must be taken into consideration that the fraction of gross domestic product (GDP) absorbed by pension spending can be expressed with a quotient which has three factors in the numerator that increase it:

[(Average amount of pensions) x (% Pensioners aged 67+) x (EDR)];

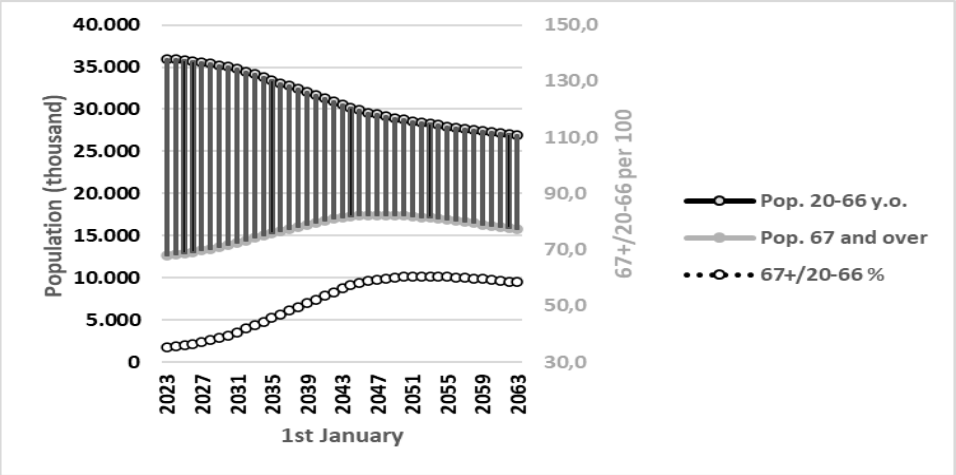
and two factors in the denominator that reduce it:

(Average productivity per employee) x (% of employed people aged 20-66).

Among the factors in the numerator (that create growth) an important place is assigned to the elderly dependency ratio (EDR), and it is easy to realize that its increase of 72% in thirty years (from 35.2% to 60, 6%) is naturally destined to

produce, under conditions unchanged by the other factors, an increase in the pension burden of the same magnitude.

Figure 7 – *Population of working age (20-66 years) and of retirement age (67e+) and Elderly Dependency Ratio (per 100).*



Source: 0wn processing in ISTAT data

A further element to consider when evaluating the critical levels of the social security system in perspective concerns the effect of what we could define as "imported ageing", i.e. the flow of entries into the universe of pensioners by individuals born abroad who have become elderly in Italy after immigration. It should be noted in this regard that currently the structure of the population of retirement age (67 years and over) can still be seen quite compatible with the number of corresponding generations born in Italy from 1922 to 1955. For example, the 723 thousand 67-year-olds resident on 1 January 2023 are the result - albeit modified by mortality and migratory movements - of the 879 thousand born during 1955, just as the 682 thousand 74-year-olds are the result of the million and 11 thousand born in 1948, or the 182 thousand ninety-year-olds derive from the 982 thousand born in 1932, and so on.

The effect of the survival and mobility processes currently still seem to respect the principle according to which those who are still present in Italy at retirement age "with x years of age" have mostly had a life path originating in Italy "x years before" and, therefore, have probably developed a corresponding career of work and contributions for pension purposes.

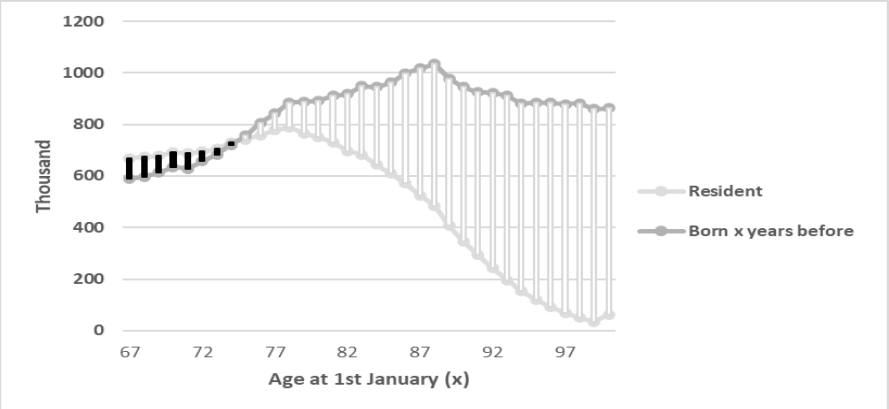
The problem that will arise soon concerns the high frequency of access to retirement age by residents who were born in other countries and who subsequently

immigrated to Italy, often in late working age. This situation, which is statistically confirmed by the overtaking of residents of age "x" on the corresponding number of births in our country "x years earlier" observable, for example, for the population of 67-74 year olds on 1 January 2053, could generate a non-marginal number of pensioners with a short contribution history and, therefore, with the need to receive forms of pension integration which will inevitably come from the general taxation.

Figure 8 - *Comparison between the population resident in Italy aged x on 1 January 2023 and the corresponding number of births registered in Italy x years before (x = 67, 68, ..., 100e+).*

Source: 0wn processing in ISTAT data

Figure 9 – *Comparison between the population resident in Italy aged x on 1 January 2053 and the corresponding number of births registered in Italy x years before (x = 67, 68, ..., 100+).*



Source: 0wn processing in ISTAT data

4. Looking at the future

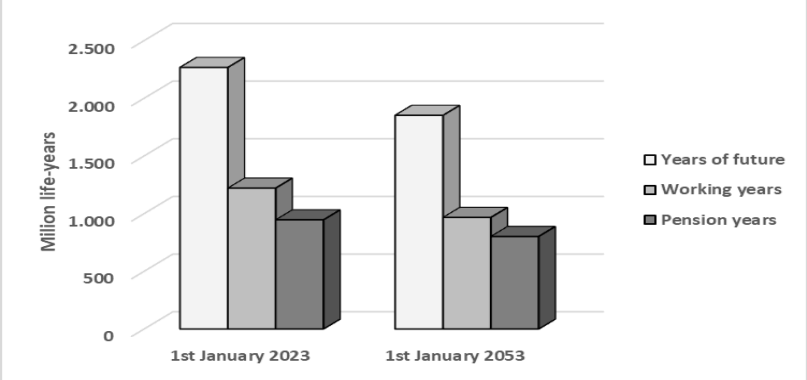
The progressive aging of the Italian population, and the way it is developing, foster some reflection on the future. In particular, the question is how much future belongs to the current 59 million residents overall, to the conditions of survival of our time, and how this "demographic asset" (the global wealth of the entire population in terms of years of future life) could change because of changes in their age structure.

According to the structure by sex and age as of 1 January 2023 and considering the survival expectations deriving from the most recent mortality tables relating to the year 2022 (ISTAT, 2023b), the "demographic asset" for all residents in Italy as of 1 January 2023 is 2 billion and 267 million life-years. If we then introduce the 20th and 67th birthdays as limits of active age, we can also distinguish within this asset one billion and 221 million life-years to be spent in working age and 946 million life-years to be spent in retirement. In perspective, 77 years as pensioners for every 100 years as workers.

If moving forward thirty years, the same calculation - conducted on the structure by sex and age as of 1 January 2053 with unchanged 2022 survival levels - leads to estimating a demographic asset of one billion and 852 million life-years for that date. Of which 967 million are referred to working age and 802 million to retirement age. The corresponding ratio between future years of retirement and those at work would thus rise by 5 points (from 77 to 82 per 100). Therefore, following the transformations in terms of size and age structure, over the space of three decades the Italian population seems to be headed towards a loss of future which will overall be equal to 415 million years of life (on average 13.8 million each year) and which will also manifest itself clearly at a per capita level: from the 38.4 life-years per resident in 2023 to the 34.6 on average in 2053.

The per capita evaluation of the demographic asset also suggests some considerations on how demographic aging has changed, and will further change, for the Italian population the relationship between the average years lived (substantially the average age) and the average years to live (the per capita expectation). The latter – as mentioned - is destined to reduce by approximately four years between now and 2053, but it should be noted that it has already been reduced to almost the same extent compared to the post-World War II values: from 41.4 life-years of 1951 to the current 38.4.

Figure 10 – *Years of future expected in total, by pensioners (aged 67 and over) and by workers (aged 20-66) in the population resident in Italy on 1 January 2023 and 2053.*



Source: 0wn processing in ISTAT data

The sex and age structure of the Italian population at the time of the "economic miracle" (the 1950s) corresponded to an average lifespan - evaluated under the survival conditions of the time - of 74 years of which 32.5 already lived (average age) and 41.5 still to live, i.e. nine years more. The similar structure in the post-Covid era (2023) reflects a lifespan that has extended by over ten years (from 74 to 84.8) but with an average lived component (46.4 years of average age) which is eight years higher than the corresponding average expectation (38.4 years). Therefore, if we must welcome, with justified satisfaction, the progress on the length of life (lived and expected), we must however also acknowledge that the gap between the path taken and the path to be taken has reversed.

In fact, can we realistically believe that a people already more than halfway through life's journey (even if on average) has kept the incentives to invest and innovate intact?

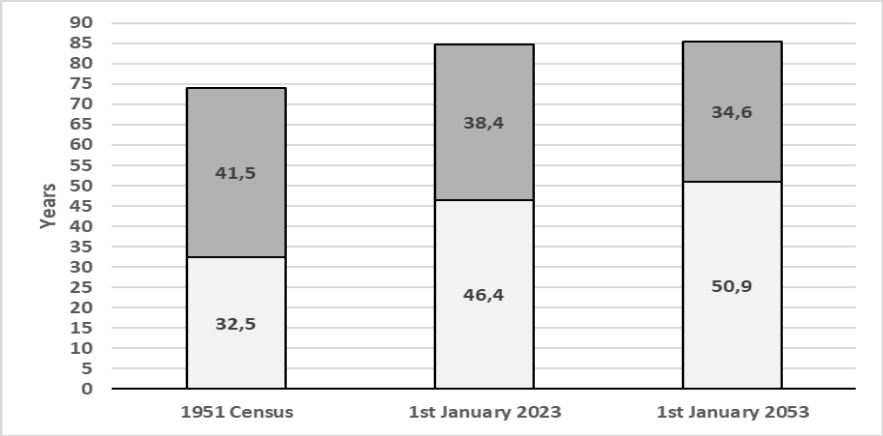
Is it reasonable to guess that we are still oriented/willing to look to the future and to sacrifice, where necessary, the consumption and well-being of the present?

The Italian "investor" after the Second World War, ready to deploy energy and resources to build a future (moreover by rebuilding a country) for himself and his family, is perhaps more and more tempted to dedicate himself to the comfortable activity of simply “maintenance”?

The question is important, and it is even more so if the gaze shifts from the comparison with the past to the vision of the future. The evaluations of the structure by sex and age of the residents as of 1 January 2053 raise the average lifespan to 85.5 years but, above all, accentuate the gap between the path traveled (50.9 years of average age) and the one to be completed (34 .6 years per capita of expected life).

Being aware of what is happening appears fundamental to prepare the necessary structural, technological, social and cultural conditions to ensure that the growing age of Italians don't become an alibi for losing desire to grow and induce to live in the present. But rather to push people to ensure that the broadest life experience, connected to the increase of average age, suggests actions and innovations capable of giving full value to the road still to be taken, even if (on average) shorter.

Figure 11 – *Relationship between past and future (on average) for Italians in the years of the "economic miracle" (1950s), today (2023) and in thirty years (2053).*



Source: Own processing in ISTAT data

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VULNERABILITY FOR OLD PEOPLE: DIFFERENCES AMONG EUROPEAN COUNTRIES

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Abstract. In this work we analyze the vulnerability of people aged 50+ living in 11 European Countries, taking into account for two aspects: a physical-economic dimension and a social one. Data come from the Survey of Health, Ageing, and Retirement in Europe (SHARE) and refer to the Covid-19 period, that is 2019-2020. Results show a geographical path of vulnerability: Mediterranean Countries register the higher vulnerability, especially in the Economic-Health domain.

1. Introduction

In 2022, over one-fifth percent (21.1%) of the EU population was aged 65 and over, with a median age of 44.4. The rapid aging of populations around the world, especially in the EU, presents an unprecedented set of challenges, including increased expenditures on health and long-term care and potential problems with old-age income security. Countries**,** as Italy, Portugal, Finland and Greece**,** present the higher share of people aged 65 or older in the total population, that is 23.8%, 23.7%, 23.1% and 22.7%, respectively, while Luxembourg (14.8 %) and Ireland (15.0 %) had the lowest shares (EUROSTAT, 2023). European Countries do not share the same behavior: the increase in the proportion of elderly people as well as the increase in the median age is higher in Mediterranean area. For instance, from 2012 to 2020 the median age of people living in Portugal, Spain, Greece and Italy have increased more than four years whereas Sweden is the only country with a negative variation (-0.1) (EUROSTAT, 2023). Moreover, the old-age dependency ratio suggests that in Luxembourg and Ireland there are one working age persons for every five persons aged 65 or over (the index is 21.3 % and 23.1 %, respectively)**,** whereas, in Italy (37.5 %) and Finland (37.4%) there are less than three working age persons for every person aged 65 or over. It is true that the growth in the relative share of older people may be explained by increased longevity. However, consistently low levels of fertility over many years have contributed to and are contributing to population ageing. Therefore, measuring vulnerability of aged people has become crucial. The concept of vulnerability has been developed and used in

various disciplines. The term vulnerability is frequently interchangeably used with frailty, dependence, or loss of autonomy and literature suggests a strong connection between older age and vulnerability. In fact, older age may, *prima facie*, be associated with vulnerability, due to a higher risk of illness and chronic diseases and older adults may be more often in contexts of situational vulnerability due to their potentially greater need for health care.

Vulnerability is not a straightforward concept, and no consensus exists regarding its meaning and definition (Lee, 2014). We suppose that everyone has a degree of vulnerability and the higher the vulnerability the higher the (negative) impact on well-being, at any age. According to UNECE (2023), elderly people experience vulnerable situations when one or a combination of difficulties arise. Those changes involve personal, environmental, or societal dimensions and risk overwhelming elderly individual capacities and resilience, with a potential negative impact on their daily life. Thus, following this setting, here, we define vulnerability as a phenomenon that encompasses two aspects: a physical-economic dimension and a social one. The first one, the physical-economic dimension takes into account for both health status and economic factors, such as difficulty in dealing with unexpected expenses, ability to save, and adequacy of housing. The social dimension includes factors such as loneliness, family and friend relationships, and social participation.

From a methodological point of view, for the construction of composite indicators it is suitable to work with continuous variables. However, in the measurement of vulnerability, usually, we deal with categorical variables. To overcome this problem, for each dimension, we compute a composite indicator by using a two-stage procedure. First, for each country, individual data are aggregated using the first stage of the fuzzy multidimensional approach developed by García-Pardo *et al.* (2021). Then, data are aggregated across individuals.

We use data from the Survey of Health, Ageing, and Retirement in Europe (hereafter, SHARE) (Börsch-Supan, 2022). Data are collected at individual and household level and sample weights are used. Among the 28 countries listed in SHARE, the analysis is conducted for 11 European countries divided into Mediterranean countries (Spain, France, Greece, and Italy), Continental countries (Austria, Belgium, Germany, and Netherlands) and Nordic countries (Denmark, Finland and Sweden). By considering Mediterranean, Central and Nordic countries we aim at capturing three different path of vulnerability and asserting that there is a hidden dimension, namely the geographical dimension**,** that also play a role in the definition of vulnerability. The choice of these countries is guided by several reasons. Firstly, within the three geographical areas, we select countries with similar socio-demographic characteristics (i.e Spain, Greece and Italy have almost identical variation on median age). Then, since historically, for an economic point of view, there are three main different economic models coinciding with geographical area,

so we are interested in finding if this is replicated also for vulnerability. Finally, we are interested in finding if there is the so-called the *longevity revolution* for Nordic Countries (see Fritzell *et al.*, 2022).

Comparisons among countries as well as a discussion of potential further research are provided. The rest of the paper is organized as follows. Section 2 provides a description of the method and the data. Section 3 presents the main results and Section 4 concludes with potential further research.

2. Data and methods

Data come from the Survey of Health, Ageing and Retirement in Europe (SHARE). SHARE is a multinational panel data survey, collecting data on medical, economic and social characteristics of individuals aged 50+. The survey covers 28 European Countries plus Israel, but here, as preliminary analysis, we focus on 11 countries that can be divided into three groups, namely Mediterranean Countries (Spain, France, Greece, Italy), Continental countries (Austria, Belgium, Germany and Netherlands) and Nordic countries (Denmark, Finland and Sweden).

We measure vulnerability by means of two dimensions: the Social domain (SOC) that accounts for 9 variables and the Economic and Health domain (ECH) with 8 variables. For the choice of the variables, we partially refer to Stranges (2013). The complete list of the variables**,** as well as the definition and the label in SHARE**,** are collected in Table 1 and Table 2.

To obtain the two indicators, we apply the first part of the methodology proposed by García-Pardo *et al.* (2021). In particular, we denote by U the population set and by h a non-continuous dimension with deprivation categories $j \in \{1, \ldots, k_h\}$. The symbol $c_{h,j,i} \in \{1, 2, \ldots, n_j\}$ denotes the deprivation symptoms of each category j for individual i in dimension h, with $c_{h,j,i} = 1$ and $c_{h,j,i} = n_j$ we denote, respectively, the most deprived and the least deprived. Thus, using the membership function defined by Cheli and Lemmi (1995) the deprivation score in category j for individual i in the non-continuous dimension h is defined as follows:

$$e_{h,j,i} = \frac{1-F(c_{h,j,i})}{1-F(1)}, \tag{1}$$

where $F(c_{h,j,i})$ is the value of the j-th category distribution function for the i-th individual in dimension h.

Table 1 – *SOC: list of variables, description, SHARE label and deprivation ($c_{h,j,i}$).*

SOC	Description	SHARE	$c_{h,j,i}$
Voluntary	Activities in last year: done voluntary or charity work	ac035d1	If ac035d1=-2, -1, 0, $c_{h,j,i}=1$ ac035d1=2, $c_{h,j,i}=2$
SportSocCl	Activities in last year: gone to a sport, social or other kind of club	ac035d5	If ac035d5=-2, -1, 0, $c_{h,j,i}=1$ ac035d5=2, $c_{h,j,i}=2$
Polpart	Activities in last year: taken part in a political or community-related organization	ac035d7	If ac035d7=-2, -1, 0, $c_{h,j,i}=1$ ac035d7=2, $c_{h,j,i}=2$
CaspIndex	CASP index for quality of life and well-being".	casp	12 ≤casp≤20, $c_{h,j,i}=1$ 21≤casp≤29, $c_{h,j,i}=2$ 30 ≤casp≤ 38, $c_{h,j,i}=3$ 39≤casp≤ 48, $c_{h,j,i}=4$
Lonely	How much of the time do you feel lonely?	mh037_	mh037_=-2, -1, 0, $c_{h,j,i}=1$ mh037_=2, $c_{h,j,i}=2$
SadDep	Sad or depressed last month	mh002_	mh002_=-2, -1, $c_{h,j,i}=1$ mh002_=-5, $c_{h,j,i}=2$
Sn_satisfy	Social network satisfaction	sn_ satisfaction	sn_satisfaction =0,-1,-2,-9, $c_{h,j,i}=1$ sn_satisfaction =s, $c_{h,j,i}=s+1$, $s\in$ {0,1, … ,10}
LifeSatisf	Satisfied with life	lifesat	satisf = -99, 0, $c_{h,j,i}=1$ satisf =s, $c_{h,j,i}=s+1$, $s\in$ {0,1, … ,10}
LifeHap	Life happiness	lifehap	lifehap=99,4, $c_{h,j,i}=1$ lifehap=s, $c_{h,j,i}=5-s$, $s\in$ {1,2,3}

Our Elaboration on SHARE data.

Once the variables are transformed by applying Equation (1), to construct the indicator at unit level, we need to aggregate them. We use a weight defined by means of two components, the first one, denoted by $w_{h,j}^{a}$ attaches more weight to categories in which the proportion of individuals in the population with deprivation in category j is smaller and the second one, $w_{h,j}^{b}$, attaches less weight to categories with redundant information. More in detail, $w_{h,j}^{b}$ is a function of the coefficient of determination that is, it is obtained using X_j as dependent variable and $X_1 X_2 \dots X_{j-1} X_{j+1} \dots X_k$ as independent variables in a multiple linear regression model. Formally, we have:

$$w_{h,j} = w_{h,j}^{a}\, w_{h,j}^{b}\text{, with } w_{h,j}^{a} = 1 - \frac{1}{N}\sum_{i=1}^{N} e_{h,j,i} \text{ an } w_{h,j}^{b} = 1 - R^2_{e_{h,j,i},\, e_{h,-j,i}}. \quad (2)$$

In (2) the symbol $R^2_{e_{h,j,i},\, e_{h,-j,i}}$ denotes the coefficient of determination associated with the regression model.

Table 2 – *ECH: list of variables, description, SHARE label and deprivation ($c_{h,j,i}$).*

ECH	Description	SHARE	$c_{h,j,i}$
Fdistress	Household able to make ends meet	fdistress	fdistress=1,99, $c_{h,j,i}$ =1 fdistress = $c_{h,j,i}$ =s, $s\in\{2,3,4\}$
AffUnExpens	Afford to pay an unexpected expense without borrowing money	co206_	co206_=-2,-1.0, $c_{h,j,i}$ =1 co206_=1, $c_{h,j,i}$ =2
AlpHealth	Health literacy: how often help needed	hc889_	hc889_=-2,-1,0,1, $c_{h,j,i}$ =1 hc889_= $c_{h,j,i}$ =s, $s\in\{2,3,4,5\}$
ADL	Number of limitations with activities of daily living (adl)	adl	adl=-2,-1,0, $c_{h,j,i}$ =7 adl=s, $c_{h,j,i}$ =7-s, $s\in\{1,2,\dots,6\}$
Chronic	Number of chronic diseases	chronicw8c	chronicw8c =-2, -1, $c_{h,j,i}$ =1 chronicw8c =0, $c_{h,j,i}$ =8 chronicw8c =2s-1, $c_{h,j,i}$ =8-s chronicw8c =2s, $c_{h,j,i}$ =8-s $s\in\{1,2,\dots,7\}$
SelfPerHealth	Self-perceived health	sphus	sphus=1,2, $c_{h,j,i}$ =1 sphus =s, $c_{h,j,i}$ =6-s, $s\in\{1,\dots,5\}$
Ndoc	Num. of medical doctor seen/talked in 12 month	doctor	doctor$\leq q25$, $c_{h,j,i}$ =4 $q25$ <doctor$\leq q50$, $c_{h,j,i}$ =3 $q50$ <doctor$\leq q75$, $c_{h,j,i}$ =2 doctor $> q75$, $c_{h,j,i}$ =1 *where q# denotes the # quantile*
QIncome	Income	thinc2	doctor$\leq q20$, $c_{h,j,i}$ =1 $q20$ <doctor$\leq q40$, $c_{h,j,i}$ =2 $q40$ <doctor$\leq q60$, $c_{h,j,i}$ =3 $q60$ <doctor$\leq q80$, $c_{h,j,i}$ =4 doctor $> q80$, $c_{h,j,i}$ =5 *where q# denotes the # quantile*

Our Elaboration on SHARE data.

Keeping the formulas in (2) in mind, for a fixed dimension *h*, the *deprivation score for individual i* according to a set of non-continuous dimensions $j \in \{1, \dots, k_h\}$ is given by:

$$e_{h,i} = \frac{\sum_{j=1}^{k_h} w_{h,j} e_{h,j,i}}{\sum_{j=1}^{k_h} w_{h,j}}\,. \tag{3}$$

Thus, the overall index for a given country is the average of those individual scores. In this way, the higher the value of the index, the greater the deprivation.

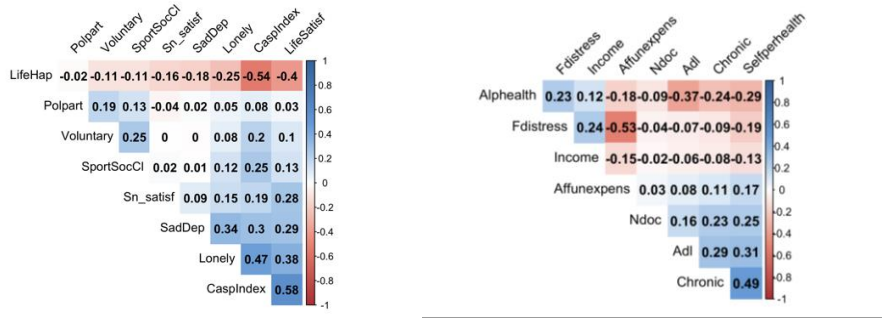
3. Results and discussion

Firstly, for both domains, we compute correlation coefficients. Figure 1 displays the results. Values do not exceed 0,58 for the Social domain and -0,53 for the Economic and Health domain and this satisfies one of the requirement in the construction of a composite indicators (Nardo *et al.*, 2008).

To compute the two vulnerability indices, we need to encode the original variables to obtain the deprivation symptoms of category j for individual i in dimension h, $c_{h,j,i}$, and, using Equation (1), the deprivation score in category j for individual i in the non-continuous dimension h, $e_{h,j,i,}$. Table 1 and Table 2 also report the transformation adopted.

The deprivation score in category j for individual i in the non-continuous dimension h, $e_{h,j,i,}$ is used to compute the two types of weights. Figure 2 and Figure 3 report the two corresponding weights for each country and all variables in Economic-Health and Social dimensions, respectively.

Figure 1 – *Correlation matrix for the variables in SOC (left panel) and ECH (right panel).*

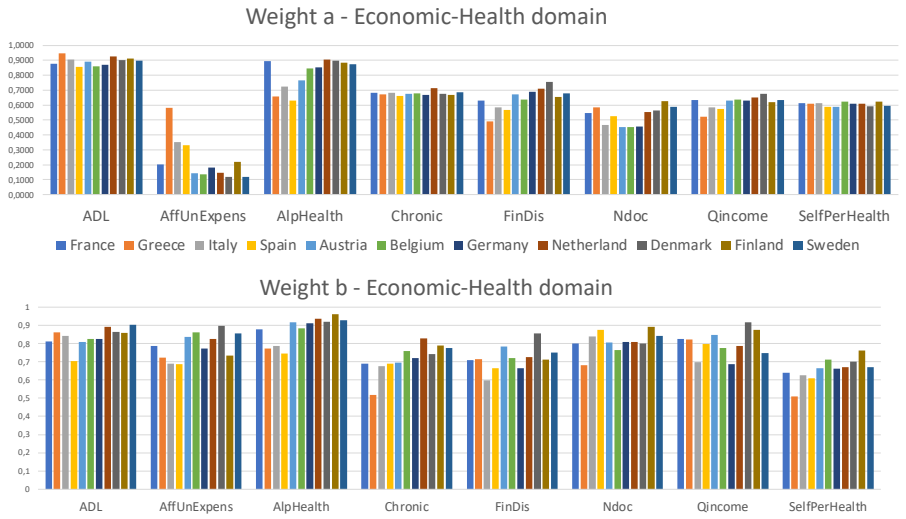


Our elaboration on SHARE data.

For the former domain, the variable *affUnExpens* registers the lower values according to the weight $w_{h,j}^{a}$. Since, according to $w_{h,j}^{a}$, less frequent deprivation should obtain higher weights, we can affirm that for this variable, almost all the individuals, in each country, reach the same values. The only exception is Greece, whose value is almost double the values achieved by other countries.

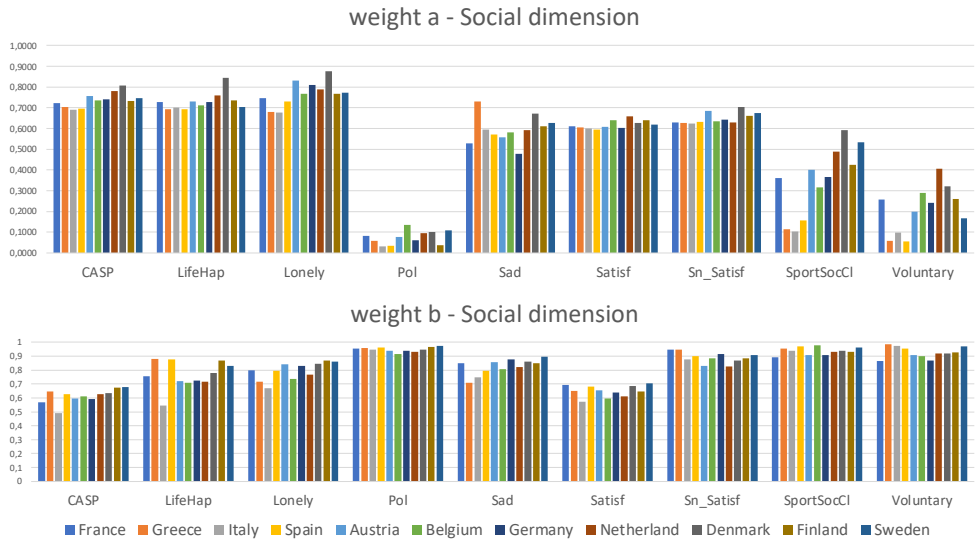
The same applies for variable *Pol* (Social domain) but in this case all the countries register similar values. For both dimensions, the values of the weight $w_{h,j}^{b}$ are similar and quite higher (between 0.5 and 1 for all countries and all variables). According to the weight $w_{h,j}^{b}$, categories that provide redundant information should be penalized, this means that the information collected using those variables is a bit redundant.

Figure 2 – *Weights for Economic-Health domain.*



Our elaboration on SHARE data.

Figure 3 – *Weights for Social domain.*

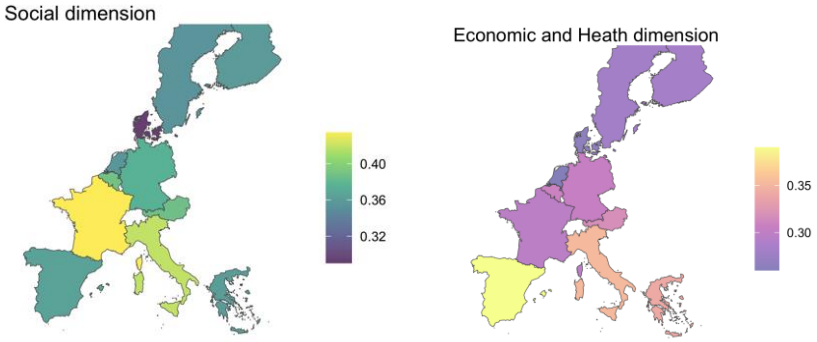


Our elaboration on SHARE data.

Before computing the composite indicator, we compute the overall weights, defined as the product of the above-mentioned weights (see Equation 2). Thus, we single out the maximum and the minimum as well as the average by country and for each variable. For the Economic-Health domain, the average values at country level range from 0.426 (Spain) and 0.546 (Finland), whereas for the Social domain, the lower values is 0.303 for Italy and the maximum is 0.490 for Denmark. If we focus on countries, Netherland, Denmarck and Finland exhibit the higher values for almost all the variables, Greece is the only exception for *AffUnExpens* and Belgium for *Pol*. If we focus on variables, for the Economic-Health domain, the higher weights are for *ADL* and *AlpHealth* wherease, *Lonely* is for the Social one.

Figure 4 displays the results of the aggregation procedure. In both cases, the lighter the colour, the higher the deprivation. Especially for the Economic and Health dimension it is easy to find a sort of geographical path: Mediterranean countries display the lower values, then Continental and Nordic countries reach the maximum values.

Figure 4 – *Composite Indicator for Social and Economic-Health.*



Our Elaboration on SHARE data.

Table 3 reports basic statistics for Social and Economic-Health dimensions.
Figure 5 displays the scatter plot between Social dimension (horizontal axis) and Economic-Health domain (vertical axis). This figure proves the existence of the geographical path mentioned above, that sees a clear difference between Mediterranean countries and Continental and Nordic countries.

To enforce conclusion made by means of the scatter plot (Figure 5), we compute the bi-dimensional (Euclidean) distance among countries (Figure 6).

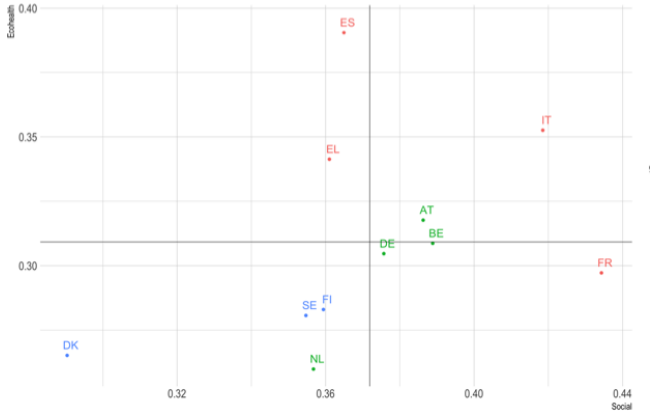
We note that there are three groups of countries which exhibit the lower distance, namely 1) Finland, Netherland and Denmark; 2) Austria, Belgium, Germany and Netherlands; and 3) Italy, France, Spain and Greece. This confirms the existing of a geographical path in vulnerability values.

Table 3 – *Basic statistics for both dimensions.*

	Min	1st Qu.	Median	Mean	3rd Qu.	Max
Social	0.2904	0.3581	0.3649	0.3719	0.3876	0.4343
Eco-health	0.2599	0.2819	0.3047	0.3092	0.3295	0.3905

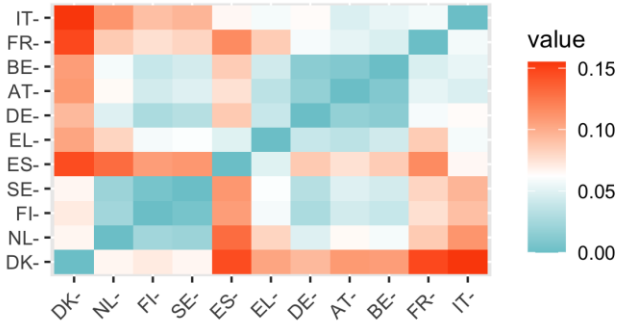
Our Elaboration on SHARE data.

Figure 5 – *Scatter plot of the two dimensions.*



Our elaboration on SHARE data. Colour: Red for Mediterranean Countries, Green for Continental Countries and Blu for Nordic Countries.

Figure 6 – *Country-distances.*



Our elaboration on SHARE data.

Finally, as a preliminary step for further research, we compute the "normalized" weights obtained applying Equation (3) and normalized to sum to 1, and we compare

them with the weights obtained using as aggregation method the Arithmetic mean. Table 4 reports those values.

Table 4 – *Insight the method: Weighted mean vs Arithmetic means.*

Health & Economic (AM= 0.111)	Normalized weights	Social (AM=0.125)	Normalized weights
Fdistress	0.124	Voluntary	0.214
AffUnExpens	0.140	SportSocCl	0.068
AlpHealth	0.167	Polpart	0.159
ADL	0.011	CaspIndex	0.129
Chronic	0.163	Lonely	0.098
SelfPerHealth	0.125	SadDep	0.110
Ndoc	0.200	Sn_satisfy	0.114
QIncome	0.036	LifeSatisf	0.108
		LifeHap	0.214

Our Elaboration on SHARE data. In brakets the values of the weights in case of Arithmetic Mean

The comparison between the equal weighted approach (that is, the weights we have by applying the Arithmetic Mean, AM) and the weighted approach above discussed reveals the variables having the higher/lower impact. For instance, for the Health and Economic domain, *ADL* has the lower impact (0.011) that is about the 10% of the weight associated with the same variable in case of equal-weights, or, in other words, the impact of the weight of this variable is about 1%. The highest is for *SelfPerHealth*, that is, almost twice the value for equal weights.

4. Conclusions and further research

This paper presents a first attempt of defining and measuring vulnerability for selected European Countries by means of two specific dimensions. The results suggest that in this type of analysis, the geographical dimension plays a crucial role. This indicates the need to provide computations at a more detailed level, specifically at the regional level. The work can be developed in several directions. Firstly, it should be interesting compare the results obtained here with those obtained using a different approach that moves from the individual score to the country index. In this direction, we are also interested in applying the so-called Weighted and Penalized approach (Ciommi *et al.*, 2017; Mariani *et al.*, 2022). It could be also of potential interest to use Principal Components Analysis (PCA) or Categorical Principal Components Analysis (CATPCA) to select a subgroup of dimensions of vulnerability that reduces the number of original variables involved. Moreover, we could also use Cluster Analysis (CA), both hierarchical and non-hierarchal (in the

case of non-hierarchical CA we can fix the number of groups equal to 3 and see if countries in each cluster coincide with the results displayed with the scatter plot. Finally, we want to try to combine the two dimensions into one (Mariani *et al.*, 2023).

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AGING THRESHOLDS IN DEMOGRAPHY AND IN LITERATURE

Silvana Salvini

Abstract. In this paper, I focus firstly on the thresholds of old age and on the data measuring aging in Italy and in Europe. Then I describe some novels with the old ages as background to understand the link between literature and some issues of demography, such as ageing in the book "The old man and the sea". This link is the purpose of my book "Letteratura e demografia" (Salvini 2023), that describes the demographic topics and some novels I read and loved in a special way.

1. Introduction

What is the definition (in individual and collective terms) of old age? And how has it changed over the centuries, according to different aspects? For example, England's Friendly Societies Act in 1875 defined "old age" as "any age after 50"; by contrast, in Scotland before the 19th century, "chronological" age was not a reason for applying for public assistance. A list, from the same period, of the registered poor people in a parish in Glasgow indicated many under 65 admitted in "old age" (Salvini, 1994).

In Western countries the definition of old age is substantially a function of the retirement age, although it is agreed that a more realistic definition must not only refer to chronological age, but must start from a functional approach, also and above all looking at the conditions of health (Livi Bacci, 1987; Caselli, Egidi, 1992). Therefore, a predetermined threshold should not be used, but, on the other hand, an answer to the question: "which parameters can be more representative for the purposes of a functional evaluation of old age?" has not yet been given with precision. At the same time, how have concepts and definitions changed over time, closely related to the increase in survival and longevity? Individual abilities and potentials must also be taken into account, being the result of the diffusion of education in the various social classes, education that brings with it interests and ways of life that are not (or should not be) the privilege of only the youth-adult age and which, if followed, therefore leads to an extension of active life.

The vision of the new old age and the division of the third from the fourth age (Laslett, 1989), leads us to talk about active aging, a process of optimizing

opportunities for health, participation and safety in order to improve the quality of life with advancing age. The European Union designated 2012 as the European Year for Active Aging and Solidarity between Generations. Beside the evolution of the old age thresholds, it is also important to describe the quality of life of old people, using, for example, the Global Age Watch Index. If the reflections on the threshold of old age involve on the one hand the demographic phenomena of longevity and, conversely, of mortality, these same reflections on the other land lead to the description of the literature on old age which in the 19th and 20th centuries focused on these ages of life and on the generational relationships.

In this contribution, I intend firstly to examine the declination that, over time, the definition of old age in society has had together with the quality of life of old people and, secondly, I intend to dwell on literature, a mirror of society, where the elderly are the protagonists. I have chosen the following novels centred on old age to understand the evolution that time of life have had over the years: *Birds Rained Down* by French-Canadian writer Jocelyn Saucier, *The Weekend*, by the Australian novelist Charlotte Wood, *Wild Strawberries* written by the great Swedish writer and director Ingmar Bergman's, *The Old Man and the Sea* written by the American Ernest Hemingway, *Fried Green Tomatoes at the Whistle Stop Cafe*, a novel by the American Fannie Flagg, the books in the series *The BarLume*, the work of the forty-year-old Pisan (Italian) writer Marco Malvaldi (Salvini, 2023).

2. Senescence and longevity

Aging process is now very different than in the past. If we compare Leonardo Da Vinci's self-portrait (1513) with a selfie of Richard Gere (2012), we would find it hard to believe that they are two men of the same age, yet they were both in their early 60s. At what age does old age still correspond to physical and mental decay? Is it an inexorable decline? The images of old age are extremely diverse, not only because different definitions are over time imposed due to the change in the conditions of life, health and activity. There are differences even in the same historical era, depending on the point of view of who is setting his reflections. Frailty (essentially the decline of strength) and the wisdom brought by experiences are distinguished in old age.

In classical Greece, old age was considered a pathology: the aging process was seen as a progressive loss of heat and vital force which makes the body of the elderly increasingly cold and dry, similar to a corpse. On the other hand, Plato's reflection underlined that man's life depended only on the soul and the inner virtues. The old man rich in memory is the repository of knowledge. In Sparta, the over 60s governed

for a period, thus giving rise to a political summit defined by gerontocracy, a symbol of wisdom.

Cicero recognized elders as having the fundamental qualities to guide society and future generations: wisdom, authority, prestige, experience and competence, dismantling one by one the clichés that see weakness in the elderly, but insisting - with unique foresight - on the importance of prevention and lifestyle for a serene, active and healthy old age. Already in the classical world, therefore, old age is not only a biological fact but also a psychological and historical-cultural destiny, which can be conditioned by practices, approaches and strategies. It is precisely here that the idea of active aging germinates for the first time. We pass from senescence to longevity: from *vetustas* to active aging.

The difficulty of looking unambiguously at the elderly derives in part from the very nature of the object we are investigating: who is the elderly? When does he become one? The answer is not immediate, because it is linked to the historical-geographical contexts and to the progressive increase in the average duration of life (in good health), which has prolonged the conditions of full self-sufficiency of the elderly over time. In the Middle Ages, a 15-year-old boy born into a wealthy family could expect to live to about 70, but birth and perinatal mortality was the order of the day, making old age an achievement reserved for the lucky few. Today, in Italy, there are 14 million over-65s and a person who has reached this milestone can expect to live for another 22.3 years. A similar figure was estimated for the inhabitants of Spain, France, Japan and Korea. In short, what was "old age" 500 years ago is no longer an exceptional phenomenon today but a widespread condition that has induced sociologists and scientists to move the onset of the third age ever further forward (followed by a fourth age and even a fifth). This process has made the definition of “elderly” more difficult, becoming a sort of umbrella term that refers to 4 different groups: young elderly (64-74 years), elderly (75-84 years), very elderly (85-99 years) and centenarians. As can be seen, the criterion of chronological age, once sufficient to identify the elderly, has become much more tenuous, losing much of its usefulness.

In the twenty-first century, aging should be understood, rather than as purely age-related issue, as a multifactorial process involving various aspects: biological, cultural, social and economic. It was once believed that old age coincided exclusively with a set of “losses”: bone density decreases, cartilage lining joints thins, muscle strength declines, sensory abilities deteriorate, nerve signal advances more slowly, just to name a few age-related changes. Today we know that as the years go by, we also acquire new skills, of an affective, social and cognitive nature.

Today, people are living longer, but they are also living better: they may become old in life, full of aches and pains, but mankind spends about two decades in an ever-increasing middle age, the active third age, which includes people in their 50s but

also people in their 70s. Only the lengthening of the last phase of life (the fourth age) is, however, associated with a greater probability of developing chronic diseases and frail conditions that can seriously undermine the prospect of healthy aging. In Italy, over 85% of people over 75 suffer from chronic diseases, such as high blood pressure and diabetes.

3. The aging process in industrialized societies

The time of aging, i.e. when a person can be considered an old man/woman, has considerably expanded compared to 30 years ago. For the average lengthening of life expectancy at birth (in Italy 85 years for women and 82 for men) a new category of seniority has been created, as has already been introduced, dividing people over 65 between those who belong to the third age (conditioned by good health conditions, social integration and availability of resources) and to the fourth age (characterized by dependence on others and physical decay, the oldest old).

In the 63rd National Congress of the SIGG (Italian Society of Gerontology and Geriatrics) (Rome, November 2018) the concept of old age was redefined. The proposal that comes from SIGG is to update the concept of seniority, raising the ideal age for defining a person as elderly to 75. A person 65-year-old today has the physical and cognitive fitness of a 40-45-year-old of 30 years ago and a 75-year-old that of a 55-year old in 1980. Today the age bar is raised to a threshold adapted to current expectations of life in developed countries. Furthermore, the state of health is introduced in the definitions, i.e. classifying the ages according to the state of health and the presence of disability. Italy's position in Europe is not among the best. That is, if life expectancy in Italy exceeds other European countries, the same does not happen for life expectancy in good health. This is a consequence of the different infrastructures and therefore of public health expenditure, which is lower in Italy (Benini, 2018) than in other European societies. Today diagnoses are made largely by sophisticated machinery which therefore manages to provide individuals with the best means for treatment, even in old age. Alongside health services, a healthy constitution and an active life are the elements for living well for a long time.

To prove these theses there are international studies on the so-called "blue zones" of the world, those places where high numbers of centenarians are concentrated. Research shows that the populations residing in these places, including Ogliastra in Sardinia, have very healthy plain lifestyles: they walk a lot because they live in mountainous areas, carry out agricultural work, have a healthy diet rich in fruit, vegetables and unrefined cereals and live in communities where the relationship with the other inhabitants is fundamental. Constant physical activity and proper nutrition are therefore confirmed as determining factors for keeping fit. If we add to this an

active lifestyle and remaining in contact with other people we will be more likely to age well and in physical and mental health.

In 2019, more than a fifth (20.3 %) of the EU-27 population was made up of people aged 65 or over. Looking at the oldest-olds, the proportion of people aged 80 and over in the EU-27 population is projected to be 2.5 times higher in 2100 than in 2019, rising from 5.8% to 14.6%. In the European Union, the population does not age equally everywhere. In fact, there are clear geographical differences both among member countries and within them. This was stated in the report "The demographic landscape of EU territories", recently published by the Joint Research Center (JRC), the CNR of the European Union (European Commission 2021; Istat, 2021a). The survey starts from the observation that life expectancy has increased significantly during the last one hundred and twenty years and, as a result of the falling birth rate, the proportion of elderly people over 65 has also increased. By 2020, 21% of Europeans - more than one in 5 - have entered their senior years and no particular change in these trends is expected, although the Covid 19 pandemic has cast serious doubts on the continuation of past trends.

The comparison between the percentage of elderly people and that of young people under 15, who together make up only 15% of EU citizens, makes it clear that demographic phenomena are destined to profoundly change the socio-economic context of the Union and that they are also an urgent issue of health welfare (Chignoli 2021). The percentage of over 80 is almost doubled in the period 2001-2020 (Istat 2021a). By 2050 persons aged 65 and over could account for 35% of the total according to the median scenario of Istat projections, while the 90% confidence interval presents a range of variation between a minimum of 33.1% and a maximum of 36.9%. In any case it will therefore be necessary to adapt social protection policies even more to such an increasing share of the elderly population (Istat, 2021b). Looking at the share of people aged 65 and over in the total population, Italy (23 %), Greece, Finland, Portugal, Germany and Bulgaria (all at 22 %) have the highest shares, while Ireland (14 %) and Luxembourg (15 %) the lowest. Over the period 2001-2020, an increase in the share of people aged 65 and over could be observed in all Member States, from the highest increase in Finland (+7 percentage points, p.p.) to the lowest in Luxembourg (+1 p.p.). The share of people aged 80 and over increased in all Member States between 2001 and 2020, with the exception of Sweden where it remained constant (5%). In some Member States, this percentage has more than doubled: in Lithuania and Croatia from 2% in 2001 to 6% in 2020, in Romania, Bulgaria and Slovenia from 2% to 5%. Turning to young people, the highest shares of those under 20 in the total population were found in Ireland (27 %), France (24 %) and Sweden (23 %), while the lowest shares were recorded in Malta, Italy and Germany (all 18%). In the period 2001-2020 there has been a decrease in the share of young people in all Member States, from the largest decrease in Malta

and Cyprus (-9 p.p.) to the lowest observed in Sweden (nearly -1 p.p.) and Belgium (-1 p.p.). France and Sweden present the highest level of fertility in Europe, due to the investments in family, children and youth.

Another way to analyse the aging of society in the EU is to look at the median age of the population. The median age increased over the period from 2001 to 2020: from 38 years in 2001, to 41 in 2010 and 44 in 2020. This means an increase of 6 years in the median age in the EU during this period. Among EU Member States, the highest median age in 2020 was observed in Italy (47 years), Germany and Portugal (both 46 years), Bulgaria and Greece (both 45), and the lowest in Cyprus and Ireland (both 38) and Luxembourg and Malta (both 40). During the period 2001-2020, the median age increased by 7 years or more in Romania, Lithuania, Portugal, Italy, Slovakia, Spain and Greece.

In short, the various parameters available identify Italy as the "grayest" country in Europe. The consequences are known to all. From the increase in pensions to the criticality of the increasingly aging labor market, everything describes a generational imbalance that must be interrupted if we want a society responsive to the phenomena of innovation, technological and otherwise: we are facing "the demographic winter" (Rosina, Impicciatore, 2022).

If, until recently, there was talk of migration replacing the falling birth rate, today it must be acknowledged that even immigrants will not be able to counterbalance the unborn. Immigrants also grow old, of course, and their fertility, often higher than the native population when they arrive (BIBLIO), then adjusts to that of the destination population, not to mention that the structure of the immigrant population according to nationality tends to change and today's immigrants come largely from Eastern Europe, with fertility as low as that of Southern Europe. Today, as average life span extends over time, the aging of advanced societies transforms something that in the past was in many ways exceptional into a mass problem. The "old", or rather who are now referred to as the "oldest old" become, tomorrow, the majority, with the costs involved (costs of pensions and of sanitary services) and the related economic activities, in every field. They represent not only a physical but a mental condition and a potentially large market.

4. Old age in the literature

Limiting my descriptions of the theme of "old age" in 19th and 20th century literature, many great romances come to mind which paint a picture of old age and then paint over events of a different nature. Always remembering the temporal change of the threshold of old age, in general the books with old age as a background can be divided into two parts: those giving an optimistic picture of it and that make

elderly characters speak of vivid memories, and those offering a sad and regretful imagine. The difference lies precisely in the words "memories" and "regrets". The former tell us about life courses, albeit alternatively happy and unhappy, thought positively, the latter complain of things not done, adventures not experienced, unhappy loves: in short, regrets.

It Was Raining Birds by French Canadian Jocelyn Saucier is an original book, centred on the old age of the characters. George Bernard Shaw wrote that old people are dangerous, because for them the future is completely indifferent, and this could be the "moral" of this novel, because its protagonists are elderly hermits who have withdrawn from society. A utopia of a future, certainly short, remains. And therefore, also a utopia of freedom, considering that brevity is always something relative. It is the story of a professional photographer in search of the survivors, now very old, of the great fires that devastated Québec in the early 20th century, destroying forests, crops and entire cities. The woman is on the trail of a man who, as a young man, managed to save himself from the fire and who, half-blinded, kept wandering among the smoking ashes, looking for some other survivors. The photographer is not lucky enough to find him alive: the man, sheltering in a hut in the northern forests together with two eighty-year-olds like him, is dead, having come to the end of his life as a hermit to get away from a world that the three old people abhor, the world of pensioners reading the newspaper on a bench in the city. But can an old man survive in the woods like this? Evidently yes, if he is in the company of two men who, in exchange for the possibility of quietly cultivating marijuana in the area, supply themselves with what they need and above all defend their privacy. The three (by now two at the time of the narration) are hermits, fugitives, who have voluntarily separated themselves from the world and who, of course, know that they must soon die, but not when Death wants them to, but when they decide to: for the purpose, they have set aside a jar of strychnine. The arrival of the photographer calls into challenges the lifestyle of the two hermits, as she enlarges the community to include an old woman who has fortunately escaped from the asylum, and even opens up the possibility of love. Death can wait; what really counts are the years, however few, that remain to be lived to the full. The novel is pleasant, somewhat sentimental, well-constructed and enjoyable, even endowed with a happy ending - this one, perhaps, a little bit contrived. On the one hand the glory of pristine nature, on the other the memory of the fires - which the once young man feverishly painted before his death, leaving behind a series of pictures where, if read carefully, his true story unfolds. A strange novel, where old age has two faces: isolation, that is, waiting for death far from the city crowd, and at the same time the company of a few with the same thoughts and desires.

The weekend, by Charlotte Wood (2019), is a book about elderly women, a group of four friends who suddenly find themselves down to three, due to the death of one

of them, Sylvie, the one who was the group's cohesive force. Seventy-year-olds Jude, Wendy and Adele are lifelong friends and, for the first time, are faced with an event - Sylvie's death - that overturns all their certainties (and insecurities) about being together. Their friendship goes into crisis with the loss of Sylvie. *The Weekend* is a richly textured novel, it's about so many things that it is difficult to describe them all. Ideas about friendship, aging and grief keep coming up, they are constantly in the three women's thoughts, with memories of the past finding their way into the present because, despite their seventies, the women are busy, difficult, vulnerable and engaging, in short very much alive. *The weekend* talks about aging, but approaching it not as an end-stage, but as a time of choosing things yet to be done, representing the future. While Adele finds herself once again relying on her charm to stay afloat, Wendy's conclusion is blunt: "Nobody wants you when you're old. […] You have to face the future […] you have to prepare yourself".

In case anyone has missed the books in the *BarLume* series, they must absolutely fill the gap. The books I'm talking about are by Marco Malvaldi, a Pisan writer (Malvaldi, 2007, 2008, 2010, 2012, 2014, 2016, 2018). The setting is Pineta, completely fictional Tuscan seaside resort and the protagonist is Massimo, the owner and gruff "barrista" (no, it's not a mistake: in Tuscan it is spelled with two R's) of BarLume. The character of Massimo, a former mathematician divorcee, is rather stormy and full of obsessions. The bar's clientele during the day habitually includes four sprightly old men: Massimo's grandfather, Amperio, Aldo the restaurateur, Del Tecca, a former municipal employee, and Rimediotti, who always occupy the same table and get mad as hell if anyone sits there. Massimo and the fantastic four old men have a deadly penchant for investigating various crimes and amidst Tuscan jokes and various amenities, they eventually manage to solve the intricate cases, not without causing a lot of trouble for the police. The characters of the almost octogenarians and their dialogues are the outline of the detective stories in the various novels, which are a great pleasure to read. Maybe it is because I am Tuscan, or maybe because Marco Malvaldi might have been a student of mine (even though he is a chemist, but he might be a statistician), I have become fond of the books, the Author and the old men. The detective stories that the novels tell are really "belline" (that means pretty said in Tuscan language..). If these novels have in common the trait of seeing the "barrista" Massimo lose his patience, exasperated by the chatter of the spry octogenarians, the narratives are each a small miracle of cheerfulness and liveliness, where the crime and the relative investigation are merely only the excuse for the exchange of hilarious jokes between the elderly, Massimo, Tiziana (such a beautiful girl!, his helper in the bar) and the unfortunate protagonists of each crime. Old age sparks at the BarLume, and these novels describe a life where there is not a sad and lonely old age. The card games, the free cappuccinos, the non-stop chatter, the detective genius that can't wait to find some good story to unravel and that their

acumen will unearth... well, they are all descriptive characters that have nothing to do with old age as narrated in so many past and present novels where one lives the last years lost in memories and regrets. Of course these stories are not milestones of literature, but their pleasantness is undoubted and - while reading them - one feels like being in Pineta, breathing the sea air, playing cards and drink the *chinotto* that Massimo appreciates at any time.

If demography deals objectively with the different ages of life, but transversally to other disciplines it favours the productive and reproductive ages for obvious connections with the phenomena of population renewal, these light novels remind us how the aging process can be experienced with the same instincts of youthful age. As Battiato wrote (1983), "desires never grow old with age", and the desire to know, to investigate, to solve cases is for the four old men still alive and dominant.

There is a melancholy atmosphere in *The Place of Strawberries*, a screenplay based on the author's film by Ingmar Bergman (1960). What is the strawberry place a symbol of? It is a place reconstructed in memory where our childhood, our adolescence, our childish self is hidden, with all the hopes we had, when life was all ahead of us, everything was to be chosen, to be tried, to be experienced. Perhaps this place also persists over the years, up to our old age, but we are not sure, we do not see it for sure even in our memories. They are the wild strawberries (the fruit of the title) collected in the garden of the childhood home of Isak Borg, an old, solitary and selfish professor, traveling from Stockholm to Lund for his university jubilee, which represents the culmination of his status of prestigious doctor and researcher. Ingmar Bergman narrates the life of the old professor between the idea of death and the encounters that distract and cheer him up during the journey to Lund. The positive encounters are those with the boys whom he gives a lift, Victor and Anders, with their quarrels about God, and Sara, full of will to live, while the bad thoughts come from the incident with a couple in eternal mutual torment and from the visit to his mother who reminds him of his failures and his loneliness. The Sara he meets takes the form of another Sara, the beloved cousin he sees in his dreams. Old age is today, but childhood and youth represent a full past and mix with questions about the existence of God, missed opportunities, "nostalgia" and love. All the themes dear to the great Swedish writer and director can be found in this novel about old age and its regrets.

Of all Hemingway's wonderful novels, the most poignant is in my opinion *The Old Man and the Sea*. Santiago, the old fisherman, and Manolin, the boy he teaches to fish and who gives him the strength to go back to the sea, are the protagonists, together with the sea. The plot of the book focuses on the duel between the old fisherman, who recalls his youth and his adventures in some flashbacks, and the swordfish, the prey that finally interrupts the long period (eighty-four days!) in which Santiago had been unable to catch anything due to terrible bad luck. The fight lasts

three days and both are very tired, but neither of them wants to give up. The old man would like to have the boy beside him to help him, but also just to feel his presence. Finally, Santiago has the upper hand: the swordfish is exhausted, the line is getting closer and closer to the boat, the old man kills it with his spear and returns home. However, the fishing is not successful because Santiago's boat is followed by sharks, attracted by the blood of the towed fish, and when the old man reaches his fish hut, only the fishbone remains. The consolation comes from the presence of Manolin, who offers him a beer and his understanding. The background to the novel is the sea, adverse and friend at the same time, which Hemingway loves, as he loves fishing and nature in general. It is in the sea that the challenge, cruel and intimate at the same time in complete loyalty, between the old man and the fish takes place. The underlying theme is the profound union between man and nature. The old man feels strongly immersed in the environment in which he has always lived, the long-awaited prey is not an enemy, but an opponent to whom, in the long struggle, the old fisherman addresses with respect, because he sees it as the symbol of nature. It would seem a useless old age, Santiago's, but passing on skills, as happens with Manolin, is already a victory, as the teacher in me would say.

Fannie Flagg's *Whistle Stop Coffee Fried Green Tomatoes* became a real literary case, an international best seller. It is a wonderful book that has seen great notoriety thanks also to the 1991 film which, although beautiful and with extraordinary actors, does not live up to the book. The book has various facets, moments rich in humour and dramatic phases, set in Alabama in the present day and after the Great Depression. The present is Mrs. Couch's life, the past are the reminiscences of old Mrs. Threadgoode, anecdotes she tells her attentive friend Evelyn Couch. The protagonists of the memories are Ruth, a very sweet and quiet girl, and Idgie, a young woman with the attitudes and behavior of an enterprising tomboy. The two women are owners of the Whistle Stop, a café opened in an isolated location in Alabama, in the deep south of the United States. It is there that encounters of varied humanity take place, decent people and bandits, violent and boorish as well as victims of the Great Depression. The society that stops at the Whistle Stop café in the 1930s and 1940s does not accept the "different", such as the black population, except as members of the servitude. Even less a homosexual love like the one that binds Ruth and Idgie who find themselves involved in a murder case, but who manage to overcome adversity and get themselves out of trouble. Fannie Flagg, pseudonym of Patricia Neal, was born in Birmingham in 1944, and is an openly homosexual American writer and actress; in her novels, in fact, are often found references to LGBTQ situations, characters and relationships. The various characters are described in an evocative manner and the elderly Mrs Threadgoode, the narrative voice of the events of the bar and their owners, is an unforgettable figure. An old woman is described here, with a very vivid memory, close to the young women

whose lives she narrates, for whom she does not feel envy but rather affection, with a free spirit of help and consolation for Ruth and Idgie, that are embodied by her listener Evelyn, afflicted by self-esteem problems, but who will re-evaluate herself through Mrs. Threadgoode's story and words.

5. Some conclusive remarks

Aging is now a widespread phenomenon in most industrialized countries. Southern Europe (with Italy) is at the top of the ranking of the oldest regions in the world. The causes of the process are essentially the falling birth rate and the increase in survival to old age. The migratory movements are not able to balance the falling birth rate and only partially the demographic decrease that now defines the future of Italy. The growing proportion of the elderly population aggravates the cost of healthcare and pensions. On the other hand, the role of the elderly is becoming increasingly important both as a support for children and grandchildren and as a resource in the economy and in society. Considering the forward movement of the old age threshold in the contemporary world compared to the past, active old age represents a truly important contribution to socio-economic development. In this contribution, in addition to describing the Italian and European aging process and discussing the progressive change in the thresholds of old age, some literary references have been included that have as background old age. Novels that help to understand the lives of people who - despite not being young anymore - manage to live a life full of meaning, interests and willingness to relate to the younger generations. I chose these novels because they represent some literary pillars of my youth and adulthood and I decided to revisit them through my academic specialization: demography.

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THEMES AND POLICIES ON POPULATION AGEING: A BIBLIOMETRIC APPROACH

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Abstract. The profound transformations that have occurred in many developing and, above all, developed countries have led to changes in the structure of populations worldwide. Currently, scientific communities are discussing how these components of population change impact and interact with social and economic conditions, medical situations and cultural factors, to shape the characteristics and dynamics of ageing. The ageing of the population poses several challenges for policymakers in many regions and countries. The labour market, health and welfare systems are some of the social contexts in which it is possible to act to face new demands of an increasingly less balanced population. This creates the need to identify possible responses within scientific communities to construct a knowledge-based institutional reaction (in terms of policies) in line with the profound changes taking place. Therefore, the aim of this article is to explore the scientific production on population ageing through bibliometric techniques to analyze scientific productivity and extract the main themes. The explorative approach allows us to intercept the main topics of discussion within the relevant communities of scholars. Through bibliometric analysis, statistical tools are applied to perform a quantitative study of the scientific production of a certain period (1985-2022), in journal articles and their metadata (e.g. authors, affiliations, citations). We extract research topics using the text-mining methods contemplated within the bibliometric approach. The results concern the identification of scientific orientations and trends useful for policy making. In particular, the results relate the number of publications in the analysed time span, author profiles and latent concepts.

1. Introduction

Population ageing is an ongoing process in which the proportion of older individuals systematically increases over time, while the share of the adult and young population declines. Generally speaking, the current ageing process reflects the combined effects of declining fertility rates and increasing life expectancy. Understanding the actual ageing structure of populations is crucial for policymakers, researchers, and organizations to address the multifaceted challenges and opportunities associated with this demographic trend shift.

Scientific studies provide valuable insights into the ageing processes of the population in many regions and/or countries. A comprehensive analysis conducted

by the United Nations (2019) examined global demographic trends and projected future population ageing patterns. The study revealed that the proportion of individuals aged 60 years and older has been steadily increasing worldwide, while the proportion of younger age groups, particularly children, has been declining. These findings highlight the magnitude of population ageing and its implications for various geographic areas.

Scientific research plays a crucial role in understanding these implications and guiding effective strategies to address the challenges and leverage the opportunities presented by population ageing. By considering the findings and recommendations from these studies, policymakers and stakeholders can develop comprehensive approaches that promote healthy and active ageing, ensure the provision of quality healthcare, and support the well-being of ageing populations.

The scientific contributions to understanding population ageing have a strongly multidisciplinary foundation. This is because the phenomenon and its implications can be studied from various perspectives. Demographers and statisticians have contributed by providing data-driven insights into population trends and projections, aiding in the understanding of population ageing dynamics (e.g. Harper, 2014; Lutz et al. 2019). Technological researchers, as explored by Mitzner et al. (2010), have examined the role of technology and innovation in supporting ageing populations through assistive devices, remote healthcare, and smart environments. In the field of health and medicine, e.g. studies by Beard et al. (2016) have examined the health policies needs and healthcare systems of ageing populations. Economists and labour market researchers, such as Bloom et al. (2014), have investigated the economic consequences of population ageing and proposed strategies to address the changing workforce dynamics. Sociologists and social scientists have focused on various topics and, among them, intergenerational relationships and social support networks (Silverstein, 2011). Psychologists and cognitive scientists, as evidenced by the work of Fernández-Ballesteros et al. (2013), have examined the cognitive and psychological aspects of ageing, identifying factors that contribute to successful ageing and interventions to enhance mental well-being. Policy researchers and governance experts, as seen in studies by the European Commission (2018), have informed the development of policies and frameworks to address the implications of population ageing, including social protection, pension systems, and active ageing initiatives.

This variety of scientific contributions needs to be the subject of further analyses to organize its outcomes and direct them towards specific practices and policies.

The aim of this article is to propose an automatic and systematic review of the existing literature on population ageing by examining the scientific output and identifying the most relevant scientific topics that could be relevant to political and policy actions, specifically focusing on science mapping.

2. Brief literature review

The phenomenon of the ageing of the population poses very cross-cutting challenges within scientific production. Researchers propose different focuses based on their investigation field, particularly focusing on policy recommendations and analyses of economic and social contexts (e.g. Reynaud and Miccoli 2019; Christensen et al. 2009; Bloom et al. 2011).

This creates the need to identify possible responses within the scientific communities that can be proposed as social policies to create an institutional response in line with the profound changes taking place (e.g. Teitelbaum, 2015 Skirbekk, 2022).

We need a methodological approach that allows us to carry out the principal themes and map the scientific production. Mapping scientific knowledge plays a critical role in comprehending a subject through literature review, synthesis of research findings, and identification of future research directions. Bibliometric methods offer a systematic and reproducible approach by employing statistical measurements of scientific production, researchers, and activities (Aria et al., 2020). These methods are widely utilized to assess the impact of fields, researchers, papers, and journals, as well as to pinpoint research gaps, trends, and opportunities (Aria and Cuccurullo, 2017). In particular, our study utilizes science mapping as a prominent technique to unveil both the structural and cognitive patterns within the field (Aria et al., 2020). Science mapping empowers us to identify, visualize, and analyze the themes and trends in population ageing research, both in a contemporary and historical context, avoiding redundancy (Callon et al., 1983; Cobo et al., 2011). This methodological approach was already used in the field of healthcare studies. Sarto et al. (2015) conducted a comprehensive mapping of research on governance in healthcare organizations by analyzing keywords from 91 articles published between 1985 and 2010. The study aimed to examine the impact of specific settings on the field of healthcare governance. Belfiore et al. (2022) conducted a review of scientific articles and patents pertaining to the Internet of Things (IoT) in healthcare. Their investigation encompassed both the research domain and practical applications, providing insights into the advancements in this field. We have two main research questions: RQ1. What are the main topics of scientific production on population ageing?; RQ2. What is the longitudinal evolution of the identified conceptual framework (and subsequent description of how the themes change)?

3. Methodological strategy: the bibliometric approach

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) model, as proposed by Moher et al. (2009), has been used to retrieve scientific publications. This provides a comprehensive framework that outlines the inclusion and exclusion criteria for selecting articles in a systematic literature review, ensuring transparency and reproducibility of the selection process. Figure 1 shows the PRISMA chart with the filter used for each step of data preparation.

In order to retrieve articles, we accessed the Web of Science (WoS) indexing database, specifically the Science Citation Index Expanded (SCI expanded) and the Social Science Citation Index (SSCI) Web of Science Core Collections, which are maintained by Clarivate Analytics. We constructed a query using both English terms commonly used to describe the topic: "aging" and "ageing."

The query used for the document search was as follows: ((TS=("population ag*"))). In the WoS database, the TS tag searches for query terms in titles, abstracts, and keywords fields of indexed documents. Quotation marks were employed to retrieve records with exact term sequences, while asterisks served as wildcards to capture term variations.

The data collection took place in early February 2023. We refined the search by selecting only articles, proceedings papers, review articles, and book chapters published in English from 1985 to 2022. The time range was based on the date of the first documents published and inserted in the WOS database to the most recent publication. We collected bibliographic data, including titles, abstracts, author names, keywords, and cited references. The documents were exported to PlainText format and screened by two selectors (AS and LD) to include only documents coherent with the query.

The initial documents' numerosity was 22,178, we excluded records without abstracts and those focusing on detailed medical procedures or practices, we retrieved a total of 4,594 documents (Figure 1).

We used bibliometric analysis to examine the conceptual structure of publications within a specific scientific field, enabling the generation of clusters that provide a comprehensive overview of diverse research in the field (Börner et al., 2003). To conduct the analyses on the entire collection, we employed the bibliometrix R open-source package (Aria and Cuccurullo, 2017), which facilitates quantitative research in scientometrics and bibliometrics.

Two complementary methods, namely co-occurrence network analysis and thematic mapping, were utilized to explore the conceptual structure. These approaches facilitated the identification of relationships among terms, key research themes, and their development over time. The degree of similarity between

publications was determined by the extent of shared keywords, indicating their association within shared research field.

Co-occurrence network analysis (Wang et al., 2019) specifically captured themes represented by sets of terms extracted from documents, such as author and journal keywords. This technique quantified the frequency of term co-occurrence in the document collection and normalized the results using the association index proposed by Van Eck and Waltman (2009). The resulting co-occurrence matrix was represented as an undirected weighted network. Community detection, performed using the Walktrap algorithm (Pons and Latapy, 2006), identified strongly linked groups of terms sharing common characteristics or playing similar roles within the network (Aria et al., 2022).

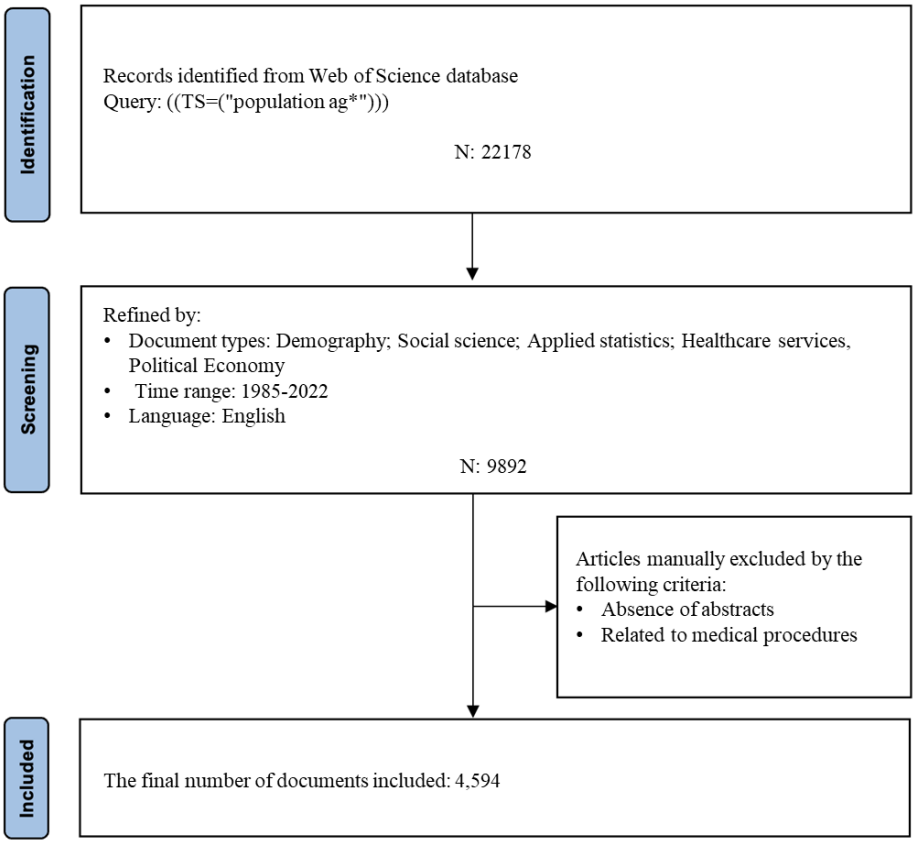
Thematic mapping, a two-dimensional representation of network findings proposed by Cobo et al. (2011), was employed to plot the identified themes. The x-axis measured Callon centrality, indicating the level of significance that a theme holds within the research field, while the y-axis measured Callon density, reflecting the degree of theme development (Callon et al., 1983). This combination of measures enabled the identification of four types of topics based on their location on the map.

The first quadrant represented highly significant and well-developed motor themes. The second quadrant comprised isolated or niche themes with limited external links, resulting in low centrality and limited importance for the broader research field. The third quadrant encompassed emerging or declining themes, indicating weak or marginal development. The fourth quadrant identified basic and transversal themes that cut across different research areas, to distinguish the emergent and decline themes we need to observe the evolution of the map during the time range selected.

Each theme was represented as a network cluster on the map, with the bubble name indicating the word with the highest occurrence within the cluster, and the bubble size representing the proportion of word occurrences within the cluster.

By employing these methodologies, the study mapped the conceptual structure of the collected scientific documents, revealing significant research topics and trends in the field of population ageing.

Figure 1 - *PRISMA diagram of the selection process.*



Source: our elaboration on WOS data.

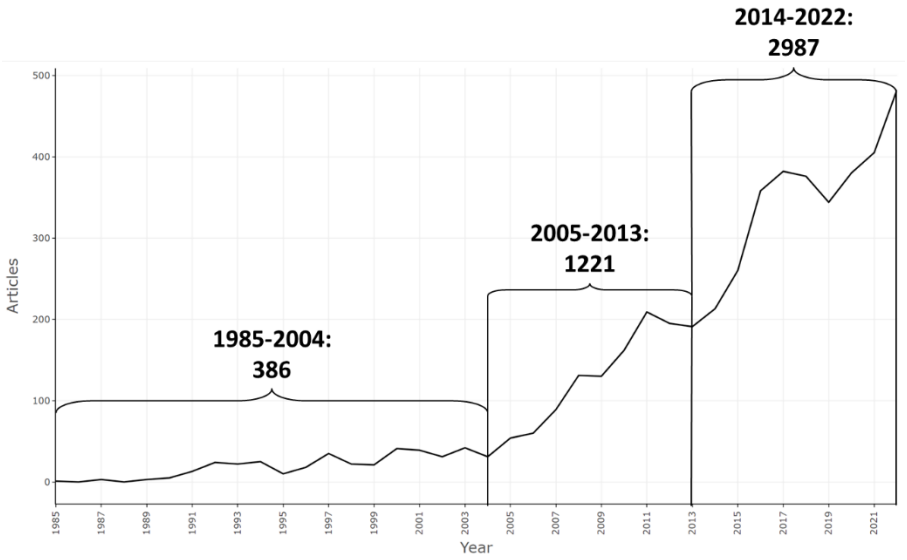
4. Results

4.1. Temporal evolution of the scientific production

The initial information extracted from the utilized library allowed us to outline a descriptive overview of the analyzed corpus. There are 2,295 sources, a relatively high number considering the applied filters, this can suggest that there are a high number of journals interested in the theme. The average number of citations per document amounts to approximately 12.86, high activity in the community about this field. The total number of authors is 10,081, with 1,081 documents having single authors.

Figure 2 displays the growth of scientific production over the examined time interval for this analysis, with an overall annual growth rate of 18.17%. The general trend was divided into 3 period-subtrends considering the increasing of papers production. As can be observed, the production remains relatively constant between 1985 and 2004, albeit with a slight increase. The total number of documents produced within this range amounts to 386. Subsequently, between 2005 and 2013, there was a significant surge in production, resulting in 1,221 papers. The final portion of the trend shows a further increase in the number of documents produced during this period, reaching 2,987 texts. We have identified these intervals as temporal thresholds on which to focus the study of the longitudinal evolution of discussion topics.

Figure 2 - *Scientific production over the years.*



Source: our elaboration on WOS data.

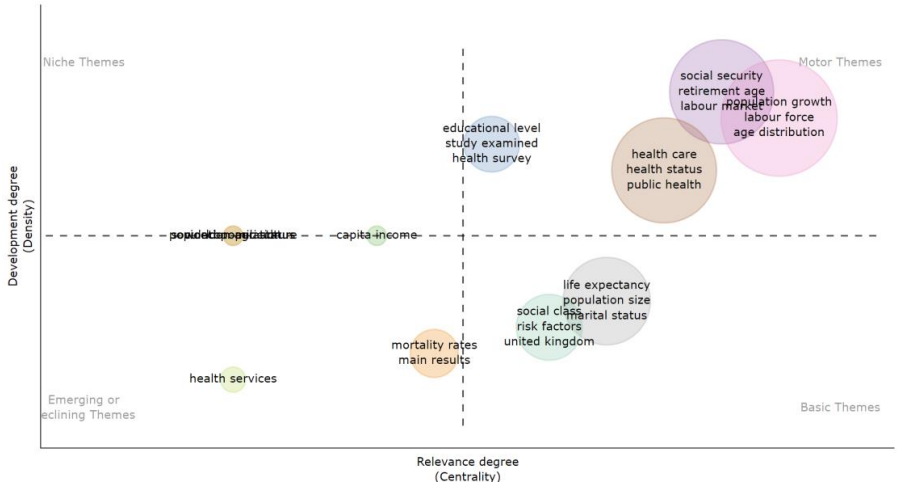
4.2. Temporal evolution of thematic

As stated previously, we have divided the text collection into three different intervals, allowing us to study the evolution of topics based on the diverse results obtained from the analyses (Figures 3, 4 and 5). The outcomes are commented on by considering the different positions of the topics within the three thematic maps.

In the first map (Figure 3), the motor themes are 4 and they relate to population growth, social security, healthcare and educational level. In the opposite quadrant

(emerging or declining themes), we find 2 emerging themes such as health services and mortality rates, which present an interesting contrast as they both pertain to the healthcare domain but follow distinct directions. As cross-cutting ("basic") themes, we find 2 topics: life expectancy and social class, highlighting the intersectionality of these topics, which are discussed in multiple fields. The topics between niche and declining quadrant (capita income, mortality rates and word population) have few documents associated, for this reason we don't consider them enough influent in our analysis.

Figure 3 - *Thematic map of studies on population ageing. First temporal threshold 1985-2004.*

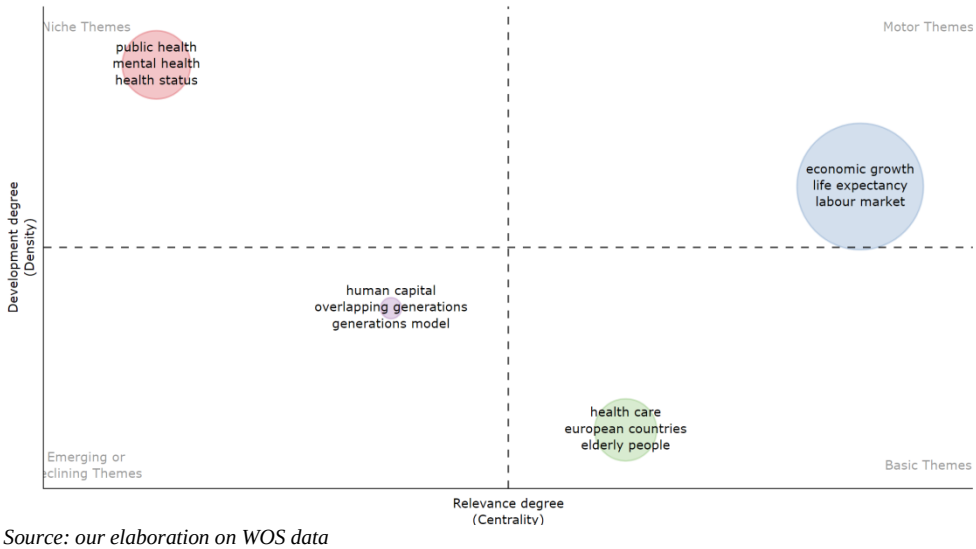


Source: our elaboration on WOS data.

The second map represented (Figure 4), presents a reduction in the number of extracted themes, totalling four. The motor theme is represented by economic growth and the labour market, while in the opposite quadrant, we find the discourse on human capital and intergenerational overlap. It is interesting to consider how, in the years of the second interval, the issue of human capital was essentially an emerging theme. Healthcare represents a basic theme, a matter for discussion among communities, while public healthcare services and mental health constitute niche topics.

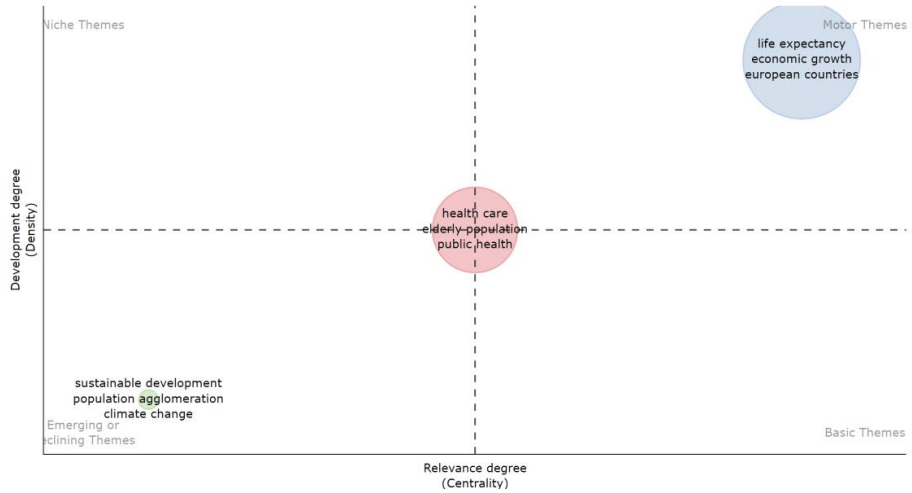
In recent years (Figure 5), we see a further reduction of themes in 3. The healthcare keywords converge into a single theme situated in the central area of the map, while economic growth remains the motor theme. Among the emerging themes, there are several works focused on sustainable growth and climate change.

Figure 4 - *Thematic map of studies on population ageing. First temporal threshold 2005-2013.*



Source: our elaboration on WOS data

Figure 5 - *Thematic map of studies on population ageing. First temporal threshold 2014-2022.*



Source: our elaboration on WOS data

5. Conclusions and discussions

This paper presents an investigation into the main directions pursued by scientific research on the topic of population ageing. The first result of the analysis that we consider important to discuss is the specialisation of the discourse around this concept. Over the years, we observe a progressive increase in the number of documents produced by scientific communities, but a narrowing down of the topics addressed. This process of specialization indicates a gradual concentration of scientific discussion around specific themes, thereby losing the general connotation that previously characterized it. There is a tendency to focus on fewer topics, the keywords shown in the outcome involve areas such as economic growth and public and private healthcare.

This leads us to reflect on another noteworthy conclusion: over the analyzed years, healthcare-related topics tend to converge, eventually forming a single central semantic block within the constructed framework. Health services bear the greatest weight in this block, encompassing prevention, healthcare treatments for improving physical well-being, and all forms of care services. The domains of public and private healthcare are also present, indicating a progressive emphasis on the services provided in both sectors.

Lastly, there emerged the dimension related to sustainable progress and the issue of climate change. This analysis reveals a particular and growing attention from the community towards these two major contemporary global challenges. These relevant topics intersect in the discussion of vulnerability, healthcare policies, as well as environmental policies such as urban planning and regulation.

This preliminary study highlights the interdisciplinary nature of the phenomenon under investigation and leads the way for future research that will investigate these aspects with more in-depth analytical methodologies.

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AGEING AND POLLUTION IN THE "TERRA DEI FUOCHI"

Simona Cafieri, Francesca Feoli

Abstract. The term "Terra dei Fuochi" refers to that territory, between the provinces of Naples and the southwest of the Province of Caserta, characterized by a history of illegal disposal of toxic substances, waste often associated with their combustion with devastating consequences for the environment, ecosystem and human health of the population living there. This case of environmental devastation is known worldwide: the scientific journal Lancet Oncology (Mazza *et al.,* 2004) coined the term 'triangle of death', in a study on cancer mortality. Currently in Campania are 90 municipalities included in this area, of which 56 are in the Province of Naples and 34 in the Province of Caserta, with a population of 2,318,407 and 618,737 inhabitants respectively (ISTAT, 2022). A study by the Istituto Superiore di Sanità (ISS, 2020) identified 2,767 illegal landfills in 38 of the 90 municipalities; more than one citizen in three, 37 %, lives 100 meters from one of these sites. This article aims to investigate the relationship between pollution, aging, and mortality through cross-referencing data from different sources, such as ISS, ISPRA, ARPAC, Campania Region, and ISTAT demo-social surveys.

1. Introduction

Demographic aging is now endemic in advanced societies; we know that life expectancy is already very different around the world and is much higher in rich than poor nations (Christensen *et al.*, 2009).

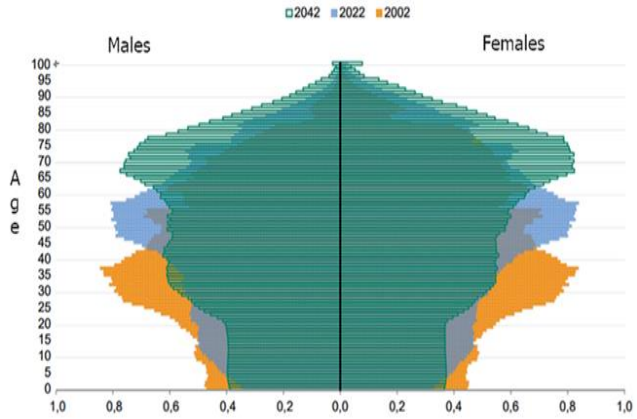
In recent years there has been an increase in average life expectancy and the main factors that can explain the gains in terms of longevity are socio-economic, physical, behavioral factors, and biomedical progress (Bartoli, 2023).

This work aims to check whether there is a relationship between pollution, aging, and mortality with a territorial focus from the national to the local level. A demographic analysis combined with an analysis of environmental data will be carried out on a small group of municipalities belonging to the "Terra dei Fuochi"

2. Ageing trends in Italy and in Campania

By comparing the distribution of the Italian resident population by gender and age group, as of 1 January 2002, 1 January 2022, and 1 January 2042[1], the change in population structure over the years can be observed, as a result of the evolution of birth, death, and migration phenomena. These demographic trends are progressively transforming the traditional population age pyramid (Figure 1).

Figure 1 – *Age pyramids in Italy at the 1st January 2002, 2022, and 2042 % values*



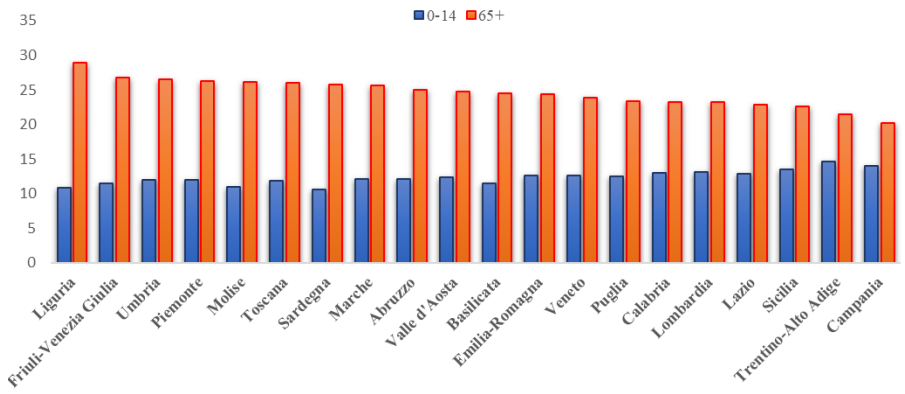
Source: ISTAT, Population by gender, age and marital status and Population and household forecasts, (b. 1.1.2021)

In developed countries, the classic pyramid shape has now disappeared due to the gradual decrease in births and hence the narrowing of the initial age classes and the shift of death to progressively older ages, with a simultaneous upward shift in the triangular shape. In the coming decades, there will be a further increase in the weight of Italy's elderly population due both to the increase in life expectancy and to the 'upward shift' (i.e. ageing) of the baby-boom cohorts, which are now in the middle age groups (ISTAT, 2022).

As far as the gender composition is taken into account, it is evident that, in the older ages, it is strongly unbalanced towards women, who enjoy a higher survival rate. Analyzing the age groups 0-14 and over 65 of the resident population on 1 January 2022 by region, it emerges that Campania is the second region after Trentino Alto Adige to have a high percentage of population in the youth group (0-14) and is also the region with the lowest percentage of population over 65. Therefore, the Campania is a young region, or better, the youngest in Italy.

[1] Data for 2042 are estimated.

Figure 2 – *Resident population 0-14 years and 65 years and over by region (% 2022)*



Source: elaboration on data from demo.istat.it database

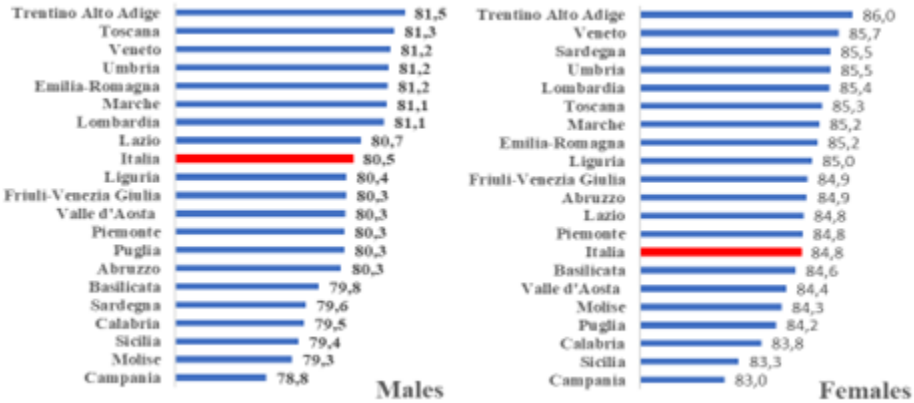
In 2022, Italy's life expectancy at birth is estimated at 80.5 years for men and 84.8 years for women; (Figure 3).

There is a significant increase for men of about 2.5 months compared to 2021.

For women, on the other hand, the value of life expectancy at birth remains unchanged from the previous year.

Campania region has life expectancy values of 78.8 years for men and 83.1 for women, making it the region where life expectancy is lowest (ISTAT, 2023).

Figure 3 – *Life expectancy at birth by gender and region (year 2022)*



Source: ISTAT, Resident Population Mortality Tables (2021) and Demographic Indicator Nowcasting System (2022)

3. The “Terra dei Fuochi”

The “Terra dei Fuochi” is the territory between Naples and Caserta, characterized by a history of illegal disposal of toxic waste (Fariello, 2019) associated with its burning, with devastating consequences for the environment, the ecosystem and the health of the population living there. This territory is a quadrilateral that covers approximately 800 square kilometers (Ministero dell’Interno, 2018); an area strongly compromised due to the high and massive presence of pollutants (Altavista *et al.*, 2004), so much so that it is considered a case of environmental devastation, now known worldwide.

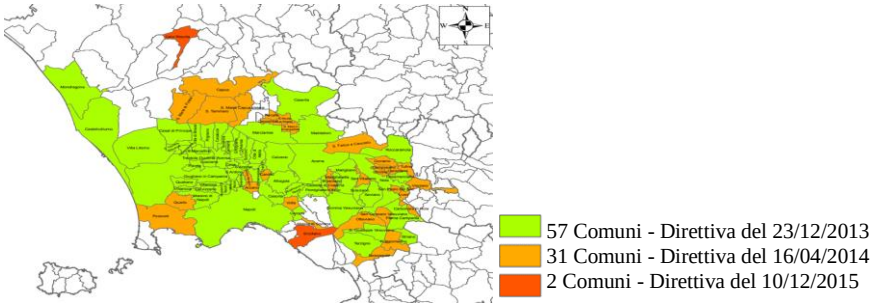
Since this is a set of illegal practices carried out in such a vast territory, we cannot identify a precise date to indicate the beginning of this phenomenon: we know that the expression "Terra dei Fuochi" was used for the first time in 2003 in the Ecomafie report (Legambiente, 2003). Then, in September 2004, the scientific journal Lancet Oncology, in a study on cancer mortality, coined the term 'triangle of death' to indicate an area between the municipalities of Acerra, Nola, and Marigliano, sadly known for the sharp increase in cancer mortality of the local population, mainly due to the illegal disposal of toxic waste (Mazza *et al.*, 2004).

Afterward, in 2007, the World Health Organisation (WHO) highlighted that a specific effect on the population was observed for dioxins due to exposure to the burning of illegal waste. Later on, in 2011, a report released by the Regional Agency for the Environmental Protection of Campania (ARPAC) showed that an area of 3 million square meters was seriously compromised due to the high and massive presence of toxic waste.

In 2016, the Campania Region launched a project in collaboration with the Zooprophylactic Institute to carry out environmental and demographic analyses on exposure to pollutants. Thereafter, in 2019, another international scientific journal 'The Journal of Cellular Physiology' published the data from the pilot study that demonstrated the high concentration of metals in the blood of patients from municipalities particularly affected by landfills and illegal spills. Finally, in 2020, the ISS published a report in which it was revealed that some serious cancer diseases are linked to the illegal disposal of waste (ISS, 2020).

Currently, in the Campania region, there are 90 municipalities included in this area (Figure 4), of which 56 are in the province of Naples and 34 in the province of Caserta, with a population of 2,926,181 inhabitants, resident population at first of January 2020.

Figure 4 – *Map of "Terra dei Fuochi" (Land of fires)*

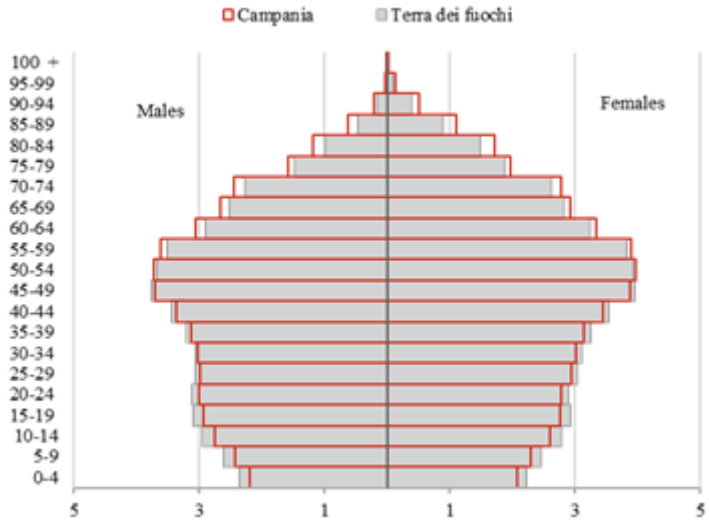


Source: Processing on Arpac data 2016

Comparing the age pyramid of the population residing in Campania with that of the population that lived in the "Terra dei Fuochi" in 2020, it can be seen that the population in the younger age groups is greater in the "Terra dei Fuochi" than in the region as a whole; from the age of 50 onwards it is the opposite.

As far as the gender composition is taken into account, it is evident that, in the older ages, it is strongly unbalanced towards women, both in Campania and in "Terra dei Fuochi", who enjoy a higher survival rate (Figure 5).

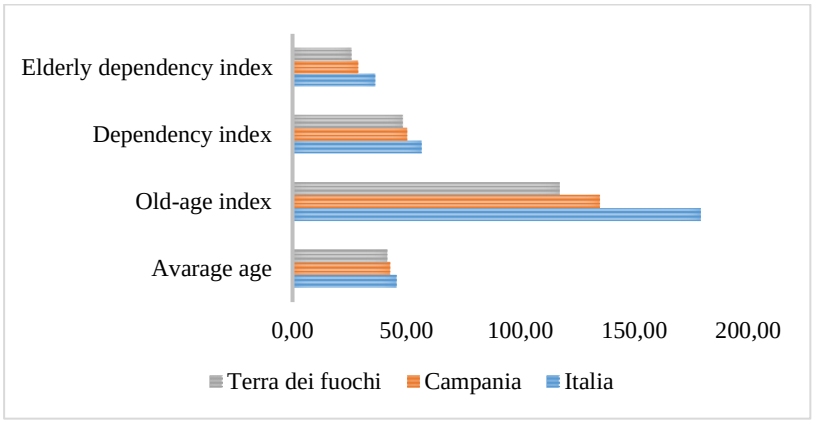
Figure 5 – *Age pyramid of the resident population, Campania and "Terra dei Fuochi", year 2020 % values*



Source: elaboration on data from demo.istat.it database

The analysis of the age structure of "Terra dei Fuochi" shows that it is a young land, as there is a lower percentage of people over 65 than the national average. The Orta di Atella municipality for example is the youngest in Italy, with more than 20% (21.6%) of the population in the 0-14 age group. All other demographic indicators are influenced by the age structure of the population in these municipalities. The old-age index[2] and the dependency index[3] of "Terra dei Fuochi" are lower than the national and regional figures (Figure 6).

Figure 6 – *Structural indicators, Italia, Campania and "Terra dei Fuochi", year 2020 % values*



Source: elaboration on data from demo.istat.it database

As in line with regional and national data, the "Terra dei Fuochi" also shows a steady decline in the birth rate[4], with 2020 registering a birth rate of -0.83 compared to 2014 (Table 1).

An analysis of the mortality rate from 2014 to 2020 shows that it is fluctuating, peaking in 2020, caused probably by the pandemic. As we know, Covid-19 has accentuated the process of demographic decline that had already begun in 2015, as it has impacted all the components of demographic dynamics (excess mortality,

[2]It is a synthetic indicator of the degree of ageing of the population It is obtained by comparing the amount of the population aged 65 years and over and that of children 0-14 years

[3]It is the percentage ratio between the population of non-working age (0-14 years and 65 years and over) and the working population (15-64 years); it calculates how many individuals there are of non-working age for every 100 of working age, indirectly providing a measure of the sustainability of a population structure. This ratio expresses the theoretical social and economic burden of the working-age population: values above 50 % indicate a situation of generational imbalance

[4] The birth rate is the ratio between the number of live births in the year and the average amount of the resident population, multiplied by 1,000.

declining births, halving of marriages, shrinking migration flows), in according to the study of Rosina (2020).

Table 1 – *Demographic statistics of the "Terra dei Fuochi"[a], year 2014-2020*

Demographic statistics	2014	2015	2016	2017	2018	2019	2020
birth rate	9,44	9,44	9,29	9,30	9,01	8,72	8,61
mortality rate	8,20	8,97	8,32	8,91	8,50	8,51	9,67
total migration rate	-1,01	-0,83	-2,14	-1,02	-2,88	-2,68	-2,32
old-age index	93,61	97,33	100,82	104,79	108,14	112,26	117,26
Elderly dependency index	22,70	23,26	23,71	24,23	24,63	25,17	25,91
Dependency index	47,60	47,77	47,82	47,91	47,93	48,06	48,47
average age	39,78	40,09	40,38	40,72	41,01	41,35	41,70

Source: elaboration on data from Istat database "a misura di comune"
Notes: [a]the rates of the "Terra dei Fuochi" are the result of the weighted average of the 90 municipal rates (the weight is the resident population as of 12/31/2020).

Moving on to analyze each of the 90 municipalities in the "Terra dei Fuochi" in the year 2020, it can be observed that the standard deviation with the highest value occurs for the Old Age Index, so for this variable, there is greater variability between observations (Table 2).

Table 2 – *Descriptive statistics[a], "Terra dei Fuochi", year 2020*

Statistics	Birth rate	Mortality rate	Total migration rate	Old-age index	Elderly dependency index	Dependency index
observation number	90	90	90	90	90	90
Minimum	4,08	5,21	-11,39	43,25	13,51	40,76
Maximum	14,45	13,98	26,19	186,59	39,29	62,20
first quartile	7,93	7,96	-4,28	83,44	20,21	43,89
Median	9,21	8,81	-0,80	98,00	22,46	45,90
Third quartile	10,21	9,90	2,55	124,97	26,32	48,29
Medium	9,06	8,93	0,02	105,89	23,60	46,46
Variance (n)	3,04	2,55	44,22	890,01	21,56	11,61
Standard deviation (n)	1,74	1,60	6,65	29,83	4,64	3,41

Source: elaboration on data from ISTAT database "a misura di commune"
Notes: [a]the average value is the result of the simple average of the 90 municipal rates.

4. Analysis of environmental data

The second part of the work focuses on the analysis of environmental data, to understand whether air pollution affects the lives of residents and in particular the over-65s. Data, available at municipal level, from *Istituto Superiore per la Protezione e la ricerca ambientale* (ISPRA) and ARPAC sources were analysed.

In this study, a sample of 7 municipalities belonging to the 'Terra dei Fuochi' was analyzed, because in these municipalities (Arpa Campania, 2022) air quality detection stations are installed.

An annual air quality index was calculated for each municipality from the annual mean value recorded by the monitoring station.

Based on the target value, an annual air quality assessment was made. The formula for the daily air quality index, as calculated by the ARPA agencies, was re-adjusted and an annual index was formulated.

The Annual Air Quality Index (IQA) is defined as the maximum of the three calculated sub-indices for the most critical pollutants: nitrogen dioxide (no2), particulates 10 (pm10), tropospheric ozone (o3):

$$IQA=\max [spm10; so3; sno2] \quad (1)$$

To develop the sub-index, for each of the 3 main pollutants, the annual average value (measured and validated by ARPAC) was compared with the limit value/annual target set by Legislative Decree 155/2010:

$$spm10 = (vpm10/vlpm10) *100 \quad (2)$$

$$so3 = (vo3/vlo3) *100 \quad (3)$$

$$sno2 = (vno2/vlno2) *100 \quad (4)$$

ISPRA calculated the parameters for a comparison with the limit values for the protection of human health established by the reference legislation (Legislative Decree 155/2010) and with the reference values for the protection of human health established by the WHO.

From the analysis of the data, we see that the municipality of San Vitaliano has the highest index of air quality (unhealthy air), followed by Casoria (Table 3).

[5] VLPM10 Limit value D. Lgs.155/2010 Civil year 40 µg/m3
VLNO2 Limit value D. Lgs.155/2010 Civil year 40 µg/m3
VLO3 Target value, Maximum daily average calculated over 8 hours (average over three years) 120 µg/m³

Table 3 – *Analysis of environmental data, year 2020*

Municipality	Average age	Old-age index	Dependency index	Elderly dependency index	Annual IQA	Outcome
Caserta	45,45	192,48	54,31	35,74	49,17	excellent
Casoria	41,26	116,47	51,24	27,57	85,00	fair
Maddaloni	41,22	114,25	49,09	26,18	57,50	good
Napoli	43,35	147,49	54,69	32,59	72,50	good
Napoli	43,35	147,49	54,69	32,59	58,33	good
Pozzuoli	43,03	142,37	51,50	30,25	65,00	good
San Felice a Cancello	41,26	111,88	51,33	27,10	72,50	good
San Vitaliano	40,32	95,79	48,99	23,97	127,50	unhealthy

Source: elaboration from demo.istat.it database and Ispra and Arpac database
Notes: There are 2 monitoring stations in the city of Naples

Analyzing the age structure of the population, in a sample of 7 municipalities, the municipality of San Vitaliano, which has higher pollution rates, has the lowest percentage of the population over 65 (Table 4).

Table 4 – *The population of the 7 municipalities by age, values %*

Municipality	Young inactive population 0-14 years		Active population 15-64 years		Young elders' inactive population 65-74 years		Great elders' inactive population 75-99 years		Centenarians 100++	
	F	M	F	M	F	M	F	M	F	M
Caserta	5,93	6,10	33,72	31,08	6,63	5,53	6,71	4,27	0,02	0,01
Casoria	7,61	8,04	33,81	32,31	5,71	4,89	4,49	3,13	0,00	0,00
Maddaloni	7,36	8,01	34,16	32,92	5,38	4,91	4,35	2,91	0,01	0,00
Napoli	6,93	7,35	33,10	31,55	6,18	5,15	6,04	3,68	0,02	0,01
Pozzuoli	6,76	7,26	33,84	32,16	5,84	5,42	4,99	3,71	0,01	0,00
San Felice a Cancello	7,77	8,24	33,15	32,93	5,05	4,60	4,80	3,46	0,01	0,00
San Vitaliano	7,96	8,84	34,17	32,95	4,61	4,30	4,38	2,79	0,00	0,00

Source: elaboration from demo.istat.it database

The standardized mortality rates[6] are calculated for the 7 municipalities of the focus and for the provinces of Naples and Caserta, they were elaborated using the standard population method; the reference population for standardization is the Italian resident population at 31 December 2020.

[6] The standardization of mortality rates by age makes it possible to eliminate the effect of ageing dynamics and the different age composition of populations.

The data show that the municipality of San Vitaliano, which has the highest pollution rates, also has the highest standardized mortality rate, for both men and women, followed by San Felice a Cancello, Casoria and Maddaloni (Table 5).

Table 5 – *Standardised mortaly rate, males and females, year 2020 values*

Municipality	Standardized mortality rate, males*10000	Standardized mortality rate, females*10000
Caserta	126,14	130,47
Casoria	141,65	133,75
Maddaloni	124,53	143,77
Napoli	149,73	146,21
Pozzuoli	129,56	132,25
San Felice a Cancello	147,40	146,33
San Vitaliano	150,88	171,09
Province of Napoli	135,30	133,33
Province of Caserta	136,80	138,20

Source: elaboration on data from demo.istat.it database

Then the correlations between the annual air quality index, the standardized mortality rate and the percentage of population over 65, by gender, in the 7 municipalities of the focus.

The correlations are all significant: negative correlations are those between IQA and population over 65, and positive correlations are those between IQA and mortality; so there is a strong relationship between the variables, but this does not allow us to say with certainty that the observed link is cause and effect or not (Table 6).

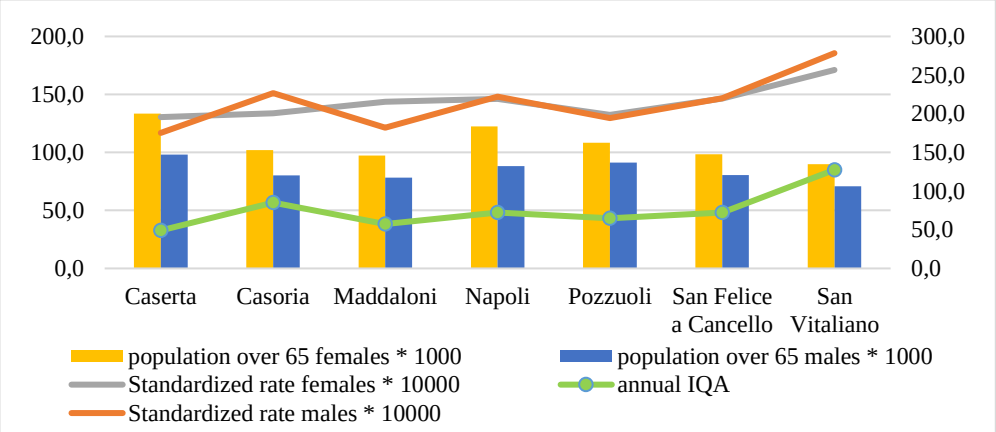
Table 6 – *Correlations between annual IQA and mortality and population over 65, year 2020 values*

	Standardized rate males * 10000	Standardized rate females * 10000	population over 65 females * 1000	population over 65 males * 1000
annual IQA	0,72	0,83	-0,63	-0,76

Source: elaboration from demo.istat.it database and Ispra and Arpac database

The data seem to show an inverse relationship between pollution and aging and a direct relationship between pollution and mortality (Figure 7).

Figure 7 – *Annual IQA and standardized mortality rates and population over 65 by gender, year 2020 values*



Source: elaboration from demo.istat.it database and Ispra and Arpac database

5. Conclusions

Despite the "Pact for the Terra dei Fuochi", in which the mayors of the municipalities concerned signed a document in which they committed themselves to take measures to combat the phenomenon of rubbish being left on roads and in public areas and to take measures for the prompt removal of rubbish, the "Terra dei Fuochi" is an area where aging is very troubled.

The analysis carried out on the 7 sample municipalities of the focus shows that there is a strong relationship between the annual air quality index, the mortality rate, and the percentage of over 65.

From data processing we see that there is an inverse relationship between pollution and aging and a direct relationship between pollution and mortality, in short, it seems that in "Terra dei Fuochi" mortality is higher, and aging is not as widespread as in Campania, Italy and Europe.

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CHILD MARRIAGE GEOGRAPHIC DIMENSION IN NINETEENTH-CENTURY ITALY

Giuliana Freni

Abstract. Despite the extensive literature on family structures and marriage patterns developed more or less uniformly in Europe, the presence of child marriage in Italy (and Europe) has not been analyzed from a demographic and historical perspective. Employing census data available for the Kingdom of Italy, this article tried to offer a spatial overview of child marriage diffusion in the second half of the nineteenth century. Despite the phenomenon was marginal, it was present in many Southern regions, especially in Sicily. However, the second and third Censuses show a drastic reduction in this marriage practice everywhere.

1. Introduction

The celebration of marriages involving minors in more or less ancient times is certainly not a breakthrough. Normally, in historical demographic literature, child brides are framed within the discourse on marriage patterns, fertility, and age at marriage, which are in turn related to family composition and its determinants. Suffice it to mention the works by Hajnal dedicated to age at marriage and celibacy (1953), and to the identification of the famous 'European Marriage Pattern' (1965). According to the first theorizing, in the territories west of an imaginary line drawn from Trieste to Petersburg, both women and men used to get married at a late age and establish a new residence while a significant proportion of the population used to not get married. The work fuelled a decades-long debate and has ensued over the years. Laslett in 1977 focused on the Western family composition and its characteristics. Many scholars have been concerned to point out the inadequacy of these models in describing marriage behaviours, especially in southern Europe. If Rowland (1988) advanced the hypothesis of a regional rather than chronological development of marriage patterns with particular reference to the Iberic Peninsula, other Italian authors tried to investigate how well Hajnal and Laslett's theories on age at marriage, celibacy, and family structures could adhere to the Italian case. Barbagli (1984) in his synthesis of the Italian modern family clearly showed the variety of structures and marriage customs among the different regions. Rettaroli (1990), using Hajnal's methods, estimated the age at marriage in Italy during the nineteenth century discovering significative differences among and within macro

areas (Centre-North and South) and also finding divergence from Hajnal and Laslett's family structures ideas. A few years later, Cocchi et al. (1996) focusing on the same period, underlined two aspects already touched on by Rettaroli and other scholars (Delille, 1977; Delille, 1985; Livi-Bacci, 1977), the role of agricultural production system (sharecropping, latifundia) and the hereditary system in influencing matrimonial choices identifying the root cause of the environmental characteristics of the area. At the same time, there have been those who have raised doubts about the rigidity of the correlation between age at marriage and neolocal or patrilocal residence. In this perspective, a neolocal residence is not necessarily associated with a high age at marriage and vice versa a patrilocal residence with earlier marriage, as shown by the example of some areas in southern Europe where a neo-local residence pattern prevails, but the age at marriage is lower (Benigno, 1989; Viazzo and Albera, 1990). In other words, age at marriage, in particular female age at marriage, represents a crucial point for research on the history of the family and at the same time the variable hardest to explain (Hajnal, 1965).

A recent paper analyzed the wedding dynamics, including the presence of young brides, in a small village belonging to the Agrigento province, Montallegro (Freni, 2023). Notwithstanding, what is probably missing is a broader historical and demographic work putting the topic at the core. This lack can be attributed to the scarcity of detailed information or simply to a lack of sensitivity towards the issue, which has been re-emerging as an imported phenomenon in Italy and other Western countries only in recent decades.

After a short description of the historical and economic picture of Italy in the nineteenth century, and the illustration of data employed, the paper intends to investigate the geographical dimension and the evolution of the phenomenon in the second half of the nineteenth century through a spatial perspective.

2. Italian socio-economic context in the nineteenth century

After the Napoleonic experience and the footprints left at the structural and institutional level, previous States were restored in Italy. All shared a low political relevance and dependency on foreign powers (Barbagallo, 2013). In March 1861 the *Mille* led by Garibaldi succeeded in the fateful feat of reunifying almost all of the Italian peninsula. However, the regions of Veneto and Friuli joined Italy only later, in 1866, while Rome including most parts of Lazio, was conquered in 1870 (Trentino Alto-Adige and Trieste only after the First World War). The new State resulted from a varied composition of elements and expressions of the different pre-union realities. The small Savoy Kingdom promoter of the unification process after the uprisings of 1848 became a constitutional monarchy and undertook an initial program of liberal

reforms. A modest spirit of reform was present in Lombardo-Veneto and Granducato of Tuscany. While the same process of renewal did not occur in the Kingdom of the two Sicilies (Meriggi, 2002). The situation in the Church-State was not so different except for new infrastructure and drainage. The different foresight of the rulers was reflected in the different impetus given to the development of communication routes, and the financial sector both necessary for the entrepreneurial activity of the bourgeois, class almost absent in the southern Kingdom. All in all, Italy was a relatively poor country if compared with the other European states, although the number of people in extreme poverty was higher in the south where even inequalities and illiteracy rates were more significant (Felice, 2013). Nevertheless, if at the end of the 1800s, the northern regions started a first timid process of industrialization, the South was still far from it. At the same time, central Italy was closer to the North than to the South. Economic differences were compounded by cultural and anthropological differences made up of mentalities, customs, and beliefs reflected in social structures, family composition, and even marriage practices still reflections of the pre-unitarian marriage regulations. In fact, the restored states reintroduced their civil codes partly influenced by the recent French experience (Sciarra, 2016) and all providing for uneven minimum requirements for validly contracting marriage. The Savoy Kingdom and the Estensi States (Modena, Reggio-Emilia, and Massa-Carrara) did not establish a minimum age to contract marriage, however, even after having reached the majority at the age of 21 for both sexes, parental consent was necessary (artt. 106, 109, 110 Codice Civile Regno di Sardegna, artt. 79-80 Codice Civile Stati Estensi). In the *Gran Ducato* of Parma, Piacenza, and Guastalla, the minimum lagal age to get married was 15 for girls and 18 for boys while parental approval was necessary for both until the age of 24 (art. 35 *Codice Civile* di Parma, Piacenza e Guastalla). The State of the Church (Roma with Lazio, Marche, Umbria) and its *legazioni* (Ferrara, Bologna, Ravenna, and Forlì) did not allow marriage before puberty (no specification of age) and stressed the necessity of true consent of the spouses. The situation was different in the South. The Neapolitan Code of 1819 allows to contract valid marriage to all girls of at least 12 and boys of 14 years old (art.152 *Codice per lo Regno delle due Sicilie*), true consent between spouses and parental approval was demanded until respectively 21 and 25 (art. 167). In the former Habsburg territories, marriage was absolutely denied for impuberants (both girls and boys under 14, art. 14 *Codice civile Generale Asburgico*). The Habsburg Civil Code differs from the others in its greater insistence on the need for true consent to contract marriage and severe penalties for those who perform marriages in the absence of proven requirements (art. 78 *Codice Civile Asburgico*).

These differences in marriage regulation were reflected in the minimum age of girls already married recorded in the first Italian General Population Census: a

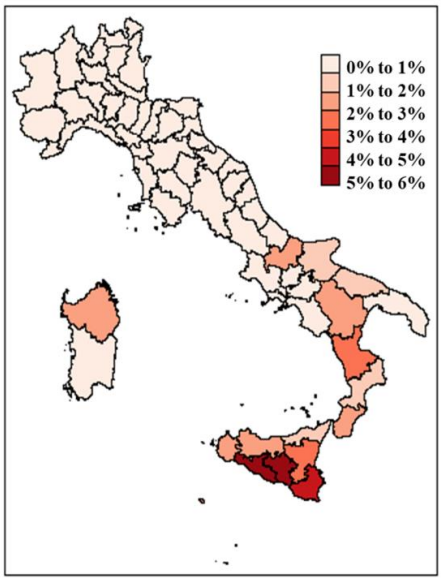
unique case of a girl of only 10 years in the province of Cosenza, and several of 11 in other southern regions, while 15 in most parts of central and northern Italy.

3. Census Data and Child Marriage

Following the example of other scholars who have investigated age at marriages and family structure in nineteenth-century Italy (Rettaroli 1990; Cocchi et.al 1996), the sources here employed are the first three Italian censuses conducted in 1861, 1871, and 1881 by the new Italian Kingdom. The 1861 Census was the first attempt of the new Italian State to have knowledge of the country and its inhabitants. As might be expected, methods of data collection and information content evolve over time, adapting to the needs and the means of the moment (Mastroluca and Verrascina, 2010). These aspects are perfectly visible when observing the different organization content from the first to the third one and affect the marital status of the population too. In fact, the first census gathers the population by age, sex, marital status, and reading and writing capability at the provincial level and within the province distinguishes between towns with more and less than 6000 inhabitants. The second one offers this classification for the entire province and for its provincial capital. Only the third one would allow a more detailed analysis providing the same information at the provincial and district level. Nevertheless, at the time of the third census (1881), the number of young married girls was so low as to leave little room for further investigation. Consequently, in order to make the three Censuses comparable among them, the present study employs the province as a statistical unit of analysis. Before going into the core of the analysis, some little premises are needed. Firstly, even though child marriage can affect both girls and boys, the formers are more likely to be involved, for this reason, the focus here is mainly on the number of child brides and child widows as a sort of indicator to measure the child marriage dimension among the Italian provinces. Secondly, here the definition of child brides includes all girls until the age of 15 already married or widows at the time of the Census. It is necessary to spend some words to explain why the threshold of 15 has been chosen. The question is not easy to address since in the past there was a different conception of childhood and adolescence. For this reason, to find a criterion as objective as possible, the present work refers to the minimum legal age to contract marriage established by law and since in pre-unitarian Italy, as shown before, there was not a unique ‘answer’ everywhere, the landmark here adopted is the new Civil Code Pisanelli introduced by the Italian Kingdom in 1866, which required a minimum age of 15 for girls and 18 for boys (art. 55). At first glance, it would appear more logical to establish the threshold at 14, rather than 15. However, an aspect to keep in mind is that the census does not offer information about the age

of marriages of Italian inhabitants, they just take a picture of the marital status, this means that a maiden of 15 may have been married most likely before the age of 15, at least when she was 14. To have a visual idea of how this marriage practice was widespread in the Italian territories, we can start mapping the percentage of girls up to the age of 15 already married (or widows) in 1861. The numerator is the number of girls of 11 up to the age of 15 already married, while the denominator is the total amount of girls of the same age present in each Italian province (n = 59).

Figure 1 – *Percentage of girls aged 11-15 who are already married or widows in the total population of girls aged 11 to 15 per province.*



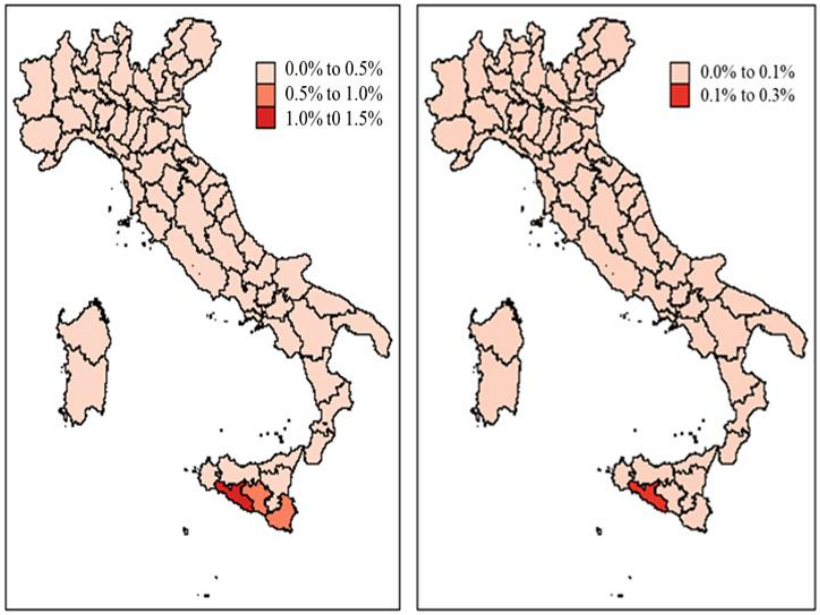
Source: 1861 Italian General Population Census.

Figure 1 shows that the rate of child brides in the total population of girls up to the age of 15 in the regions belonging to Italy in 1861 was between 0% and 6%, with prevalence in the southern regions, especially in the southern provinces of Sicily. While in the ex-Kingdom of Sardinia, the rate is between 0% and 2% (Sassari Province).

The second census realized just ten years later (1871), shows a sharp reduction of young brides/widows everywhere, including those provinces more affected according to the previous census, while in the third one, the figures appear negligible in all peninsula and islands. However, the area still interested remains southern Sicily corresponding to the provinces of Siracusa, Caltanissetta, and Agrigento. It is difficult to give a valid explanation for this consistent decrease of unions involving

very young girls in a so short time. However, it is worth remembering that the period between 1861 and the end of 1866, can be considered a sort of 'transition' since most of the regions were politically reunified under a unique State, but still, many aspects of civic life, including marriages, were regulated by the pre-unitarian States rules. Only in 1866, the new Civil Code Pisanelli was adopted introducing a nonreligious marriage and, among other requirements, a new minimum age to enter into marriage: 15 for girls and 18 for boys, with the need for parental consent until 21 for both (*Titolo V del Matrimonio*). It is possible to hypothesize that these aspects may have influenced marriage choices even if not everywhere in the same way. The third Census (1881) confirms the same direction providing figures even lower, proof that the phenomenon was starting significantly to decrease (at least in official documents) until almost disappeared even in southern Sicily, despite the province of Agrigento still registering the highest values.

Figures 2-3 – *Percentage of girls aged 11-15 who are already married or widows in the total population of girls aged 11 to 15 per province.*



Source: 1871 and 1881 Italian General Population Censuses.

4. Spatial Analysis of the 1861 Census

To better grasp the meaning of the phenomenon of child marriage as embedded in a specific geographical context, the analysis focuses mainly on its spatial dimension. Data here employed come from the marital status of the first Census when the phenomenon was most appreciable and takes into account all Italian female citizens from 11 up to the age of 15 considered the threshold age to define a girl as a child bride, or better, a 'child-wife'. Spatial autocorrelation (or spatial dependency) is calculated using univariate global Moran's index (*I*) (Moran, 1948; Cliff and Ord 1973). The formula currently used to obtain the Index is:

$$I = \frac{n}{W} \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} Wij ZiZj}{\sum_{i=1}^{n} Z_i^2} \quad (1)$$

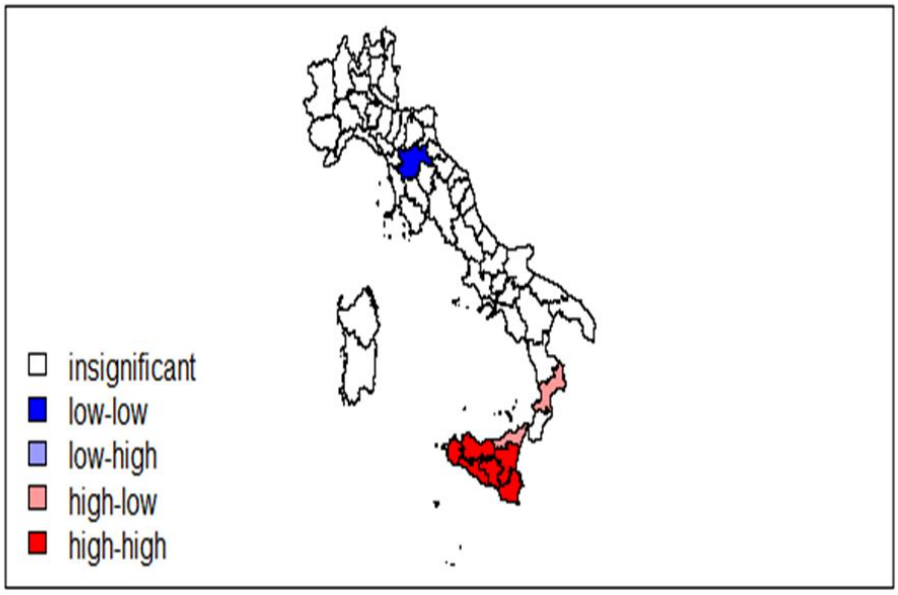
Where n is the number of observations, here (n = 59), W is the sum of the weights wij for all couples in the system, $Z_i = x_i - \bar{x}$ is the value of the variable at location i and the $\bar{x}$ mean value of the variable under observation (Kalogirou, 2018). The *Moran I statistic*, whose value is between -1 and 1, in our analysis is equal to 0.68, therefore the variable observed (the percentage of brides/widows of 11-15-year-old for each province) is positively autocorrelated among the Italian provinces in 1861. The result is not surprising since normally spatial data tend to show positive spatial autocorrelation as a result of the first law of geography (Tobler 1970, 'everything is related to everything else, but near things are more related than distant things') However, the *p*-value < 2.2e-16 confirms the statistical significance of the model. To discover if these percentages of child-wives can be attributed to a territorial location we can resort to Local Moran's *I* (Anselin, 1995). The following formula defines it:

$$\mathrm{Ii} = \frac{(y_j - \bar{y})}{S_i^2} \sum_{j=1, j \neq i}^{n} (w_{ij} (y_j - \bar{y})) \quad (2)$$

where n is the number of geographical units, y_i is the value of the variable y in area i, $\bar{y}$ is the sample average of the variable, y_j is the value of the variable y in area j *and* S_i^2 is the standard deviation of y, and w_{ij} is the weight corresponding to the inverse distance among the different geographic areas. First-order contiguous neighbors are defined using the queen contiguity weight matrix. It expresses the relationship between the value for one observed variable at a location k, Z_k and the mean values for another variable in the neighborhood $Z_l W_{kl} Z_l$ (3). Those areas for which the LISA (in this case the Local Moran's I) is significant represent the local spatial clusters, or hot spots (Anselin, 1995). For the present analysis, the pseudo-significance (pseudo-

p-value) of the bivariate LISA statistic is evaluated at 1%. The LISA map identifies three types of local association: a statistically significant cluster of high values of the variable observed (High–High, in red) corresponding to all the Sicilian provinces, but Messina; a cluster of low values surrounded by low values areas (Low–Low in bright blue) identifying the province of Florence, and finally two spatial outliers, corresponding to negative values of Local Moran's, which is an area behaving considerably differently from its neighbourhood, in this case, high values surrounded by low values corresponding to the province of Catanzaro and Messina **(**High–Low, in pale red). The provinces in which no local association was found are white.

Figure 4 – *Child Marriage Spatial Autocorrelation Map*



Source: 1861 Italian General Population Census.

5. Discussion

As suggested in the previous sections, it is possible to infer that where the minimum legal age to contract marriage was lower, child marriage was more socially accepted and thus more widespread. However, there were some exceptions. In fact, the lowest numbers in absolute values and percentages are recorded for the Abruzzo provinces and for *Terra di Lavoro* (Caserta), both areas of the Kingdom of two

Siciles but closer to another ex-State, the State of the Church. Again, space seems to matter even more than institutional factors and the first law of geography cannot be ignored. In other words, because of spatial propinquity, these areas seem to have, at least regarding nuptiality customs, more in common with central Italy than with the provinces of Calabria or Sicilia albeit belonging to the same pre-Unitarian State. Since all of Italy was mainly Catholic, it is fair to wonder what the position of the Catholic world was regarding child marriage. The low percentage recorded in the State of the Church and in its *Legazioni* (Umbria, Pesaro-Urbino, Macerata, Ascoli-Piceno, Forlì, Ferrara, and Bologna, and after 1870, in Rome) seems to be coherent with the active role played by priests in contrasting early and forced unions (Lombardi, 2008), according to the Tridentine rules on true consent (Giraudo, 2007). Nevertheless, the introduction pages *(Considerazioni Generali)* of the first census offer a different perspective in this regard. In the overview, the author does not hesitate to comment on the presence of 11-15 and even a unique case of a ten-years-old girl already married in some provinces of the Kingdom attributing this oddity to the religious interference by the clergy who allowed what is condemned by 'hygiene and public moral'. These few lines in the introduction of an official public document are significant since they offer the perspective of the institutional powers (thus of the 'establishment') towards this issue. The comment attributes the presence of married adolescents to marriage control by religious powers and it becomes the occasion to claim a lay control over marriage following the French example. According to Giuseppe Battelli (1992), the nineteenth century represented a period of transition for the Italian clergy who decided to start a new and closer interaction with the community transforming the parish into the new active center of religious life and slowly chipping away at the centuries-old bond with the aristocratic class. Likely, this process did not happen everywhere in the same way.

The other key lecture goes back to a beaten road: the agriculture production system. Indeed, the geographical distribution of child brides seems consistent with the literature on the link between age at marriage, family structure, and type of agricultural production system (Cocchi et al.1996, Franchetti, Sonnino 1876; Livi Bacci, 1977). According to this strand, lower age at marriage is found in areas where latifundia prevailed. The key players here are large landowners and day laborers. The latter tended to establish a new residence and marry before landowners or sharecroppers, having nothing to inherit (Barbagli 1987). Assuming a prevalence of hypergamous marriage, in which the groom is older than the bride, the younger the former the younger the latter. Actually, in the provinces of southern Sicily and Basilicata latifundia and feuds have been the rule for many decades. This result is coherent with the estimation of the (singulate) mean age at marriage in 1861 Italy offered by Rettaroli (1990) who showed that the lower male and female mean age at first marriage of unification were found in southern regions, especially Sicily and

Basilicata. Here men used to get married around 25-26 years old and women at 22, while in central and northern Italy, the averages were respectively 27-28 for men and around 24 for women.

6. Conclusion

The spatial analysis using 1861 Census data applied to investigate the presence and the dimension of child marriages in nineteenth-century Italy demonstrates that the phenomenon was spatially correlated and unevenly diffused through the country being prevalent in the southern regions, especially in Sicily, which represented a hot spot of child marriages. Moreover, it is not surprising to find the highest percentage of child wives, and thus of child marriages, where the minimum legal age to get married was lower, namely, 12 years for girls and 14 for boys (*Codice del Regno delle Due Sicilie* del 1819, Title V *Del Matrimonio*). This was the picture at the moment of Unification. However, by observing subsequent Census data (1871 and 1881 Censuses) on marital status, a drastic reduction all over the country is visible. It is hard to justify a so rapid decrease even in the areas more affected. The change of the Civil Code in 1866, which introduced a nonreligious marriage and raised the minimum age requirements with respect to some previous legislation (e.g. *Codice del Regno delle Due Sicilie*), seems to have had a role, at least in official statistics. Of course, it would be reductive to think that a Code is able to change decades, if not centuries, of marital traditions and behaviors. In addition, even within the borders of the same pre-unitarian states, (the reference is again to the Kingdom of two Siciles) the presence of child brides and the minimum age at marriage recorded in each province varied significantly. Two other possible interpretations have been offered, the first one related to the prevalent agricultural product systems, the second one to the role of the church. To conclude, many questions are still without an answer, since even if less free than now, marriage choice was the result of many factors strictly embedded in a social, cultural, and economic context. For this reason, census aggregate data at the provincial level are not sufficient and to add new pieces to the research framework on this phenomenon individual data on marriages and spouses are needed.

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GENDER DIFFERENCES IN COUPLES' CIVIL UNION PROPERTY REGIME[1]

Eugenia De Rosa, Vincenzo Napoleone

Abstract. Property regime is a key indicator to investigate intra-household inequality in wealth. In Italy, the community of property is for the default property regime. However during the years a growing diffusion and prevalence of the separation regime has been observed. Various explanations have been developed for marriages focusing on couples' asymmetry. Little is known about same-sex couples where separation of property is the most popular property regime too. Using data from the total Survey on Labour Discrimination against LGBT+ people (in civil union or formerly in union), carried out by Istat and Unar in 2020-2021, the main aim of this study is to investigate if there are gender differences in the property regime option between women and men couples in civil union in Italy and explore the main associated factors for choosing one type of property regime or the other.

1. Introduction

Intra-household inequality in wealth is an under-researched area. Research has documented that partners are increasingly more likely to separately keep and manage at least part of their economic resources, which means that couplies' partners may have unequal access to the household's monetary resources (e.g. Bennett, 2013; Frémeaux and Leturcq, 2020; Sauer *et al.*, 2021). Property regime is a key indicator to investigate intra-household wealth inequality offering an objective measure of how resources are pooled between spouses and specifically addressing the allocation of wealth. The separation of property is the matrimonial property regime under which each spouse retains exclusive ownership of property acquired during the marriage.

In Italy, the reform of the Family Law in 1975 introduced the community of property as the default property regime. However, over the years, we have observed a growing diffusion and prevalence of the separation regime. At the end of the 1970s, 81.2% of celibate and unmarried couples in their first marriage adopted the

[1] This article is the joint work of the authors, however paragraphs 1, 2, 3.1 and are written by Eugenia De Rosa, paragraphs 3, 3.2, 4 by Vincenzo Napoleone.

community of property, while by 2015 this percentage has decreased to just 29.0% of spouses.

Various explanations have been developed about the prevalence of the division of property. They refer to: a) instrumental motivation; b) value motivation and c) the role of the family of origin. The first one is based on the consideration that, in general, opting for a division of property is simpler from an administrative point of view, but also with specific reference to either the management of inheritance or considering a hypothetical end of the marital relationship. Independent workers, in particular, may choose this regime to safeguard their family's assets in the event of bankruptcy. Secondly, the value motivation refers to a statement of principle that stresses managerial autonomy based on a concept of formal fairness. This strategy aims at maintaining and consolidating individual identities, in contrast to those who choose the community property regime, which fosters a sense of community and is typically associated with more conservative contexts. Finally literature highlights also the conditioning by the family of origin who are going to pass on real estate and capital to their children and who are therefore interested in protecting their heirs, also for the future, regarding the availability of these assets (Facchini, 2009).

Recent studies focus on couple asymmetry. By asymmetry, we mean a relationship in which there is an imbalance, even of power, between two subjects or groups. They show that couples with economically advantaged husbands (i.e., older, more educated husband, or employed husband and unemployed wife) were more likely to choose the community of property when compared with couples with similar resources, e.g. both employed spouses, similar age or educational attainment (Fraboni and Vitali, 2019). Conversely, couples with economically advantaged wives were more likely to choose the separation of property (ibidem). Previous findings for Italy, also, show that couples composed by a foreign spouse and a native one are more likely to choose community of marital property than couples of native spouses, hence protecting the foreign spouse with equal sharing of marital wealth in case of divorce, independently of their gender (ibidem).

Little is known about same-sex couples. Since July 2016 in Italy the union of same-sex persons over 18 has been regulated by a special institution named civil union. It differs from marriage which is only for different-sex couples. In 2021, 2,148 civil unions were celebrated in Italy (Table 1). As for marriages (73.4%) also for civil unions celebrated in 2021, separation of property is the most popular property regime chosen by the 71% (I.stat).

Table 1 – *Marriages and Civil Unions in Italy (2017-2021)*

	2017	2018	2019	2020	2021
Total Marriages	191,287	195,778	184,088	96,841	180,416
Civil Marriages %	49.5	50.1	52.6	71.1	54.1
Civil Unions	4,376	2,808	2,297	1,539	2,148

Source: Istat (2023).

International literature suggests that same-sex couples have a greater adherence to equity norms and are more committed to dividing tasks equally (Chauvin and Lerch, 2016, p. 58; Ferzli, 2001). Other research highlights that person's sexual orientation and gender roles may play a role: male and female couples do differ in how they divide tasks (Jaspers and Verbakel, 2013). Additionally, inequalities related to differences in age, citizenship, income and parental roles between gay and lesbian parents exist (Chauvin and Lerch, 2016, p. 59).

In Italy, we observed a progressive convergence in the family expectations and cultural models of heterosexual and homosexual couples; the heterosexual has been considered a model for a long time, both for the loving dimension and a stable relationship.

The study of the distribution of resources within same-sex couples in Italy is an unexplored field. A first exploratory study on asymmetries within couples in civil unions has been conducted using administrative sources (De Rosa *et al.* 2022). It shows higher education heterogeneity and a higher rate of mixed couples than in marriages.

The study also shows that the probability of an educational gap between partners is higher among same-sex male couples than among female couples in a civil union, also because the age gap between partners is wider for the formers; it decreases when the couple is made up by Italians alone.

The main aim of this paper is to investigate if there are gender differences in the property regime option between women and men couples in civil union in Italy. It addresses several open questions within the emerging literature concerning gender differences among same-sex couples, wealth gap between partners and the existence of norms around pooling and sharing**.**

2. Data and Methods

This study is based on data from the total Survey on Labour Discrimination against LGBT+ people (in civil union or formerly in union), carried out by Istat and

Unar (Anti-Discrimination Office) in 2021-2022, as part of the project Labour discrimination against LGBT+ people and the diversity policies implemented in enterprises (2018-2023).

The survey was addressed to over 21,000 Italian residents who, as of 1 January 2020, were in civil union (Law 76/20 May 2016), or formerly in civil union (due to dissolution of the union or death of the partner), considering both civil unions celebrated in Italy and the transcriptions of unions (or similar institution) celebrated abroad.

A CAWI survey based on a self-administered web questionnaire was conducted and self-identification of respondents as LGBT+ was a key principle adopted. About 9,000 questionnaires were sent and validated; a post-stratification non-response was carried out. The main results of the Survey on Labour Discrimination against LGBT+ people (in civil union or formerly in union) were published in 2022 (Istat, 2022).

The main investigated phenomena were: coming out, experience of discrimination while looking for a job or while working and discrimination in other areas of social life (e.g., at school), microaggressions, aggressions, and hate speech. A specific section of the questionnaire covered aspects related to the celebration of the civil union and the couple's relationship. It includes a specific question about the matrimonial property regime, indicating the choice between a shared or separate ownership of assets accumulated during civil union.

The main aim of this study is to investigate from a gender perspective the characteristics of couples in civil union in Italy who choose to pool their economic resources and those who choose the separation of property. Combining descriptive statistics and multivariate analysis, it explores the interaction among the socio-economic characteristics of partners in civil union, their family background, family model, employment status, type of job, relationship features, family support and their likelihood of choosing the community of property.

The population of this study is people in civil union or formerly in union, living in Italy and openly declaring a homosexual or bisexual orientation, and whose union does not derive from a heterosexual marriage transformation and answered the question about the property regime included in the questionnaire (20.115 units).

The article models the probability that a person in civil union chooses the community of property with a logistic regression model incorporating every single covariate at the $P < 0.05$ level, with multinomial logistic regression models, which allowed to calculate odds ratios (OR) with confidence intervals at 95%. Variables as regressors in the models are sex, age, level of education, geographical area, employment status, and the type of job (dependent/independent), reason for civil union ("the civil union guarantees certain rights" versus other reasons), cohabitation before the civil union, family support, cultural capital of the family of origin. All regressors are dichotomous, exception made for quantitative variables (e.g. age).

3. Results

Same-sex couples in civil union represent a specific group of LGBT+ population living in Italy. 95.2% people in civil union or formerly in union who live in Italy declared a homosexual or bisexual orientation[2]. They indeed evidenced some specific features for being in their majority men (66.9%), older people (43.6% are 50 years old and over), highly educated (38.8% have at least a university degree), living in the North of the country (61.2%), opened and well integrated in the labour market.

In general, they judge their own economic condition to be good: with reference to the 12 months preceding the interview, almost seven out of ten people consider the economic resources of the household (all the people with whom they live) to be adequate. About one in four respondents comes from a family where both father and mother have at least a diploma; 15.6% have at least one of their parents with a university degree.

Women, who on average are younger (20.2% are under 35, against 11.9% of men), live more often with their partner and children (18.9% of lesbians, 23.7% of bisexual women, against negligible values for the male counterparts). On the whole, 8.4% have cohabiting or non-cohabiting children (19.9% among lesbians and 26% among bisexual women, against values close to 2% for men); the incidence drops to 7.7% if only minor children are considered. Almost half of the homosexual and bisexual people interviewed said they had joined a civil union because "the civil union guarantees certain rights" (48.9%), while more than a third indicated as their main reason: "the union seemed to me to be the natural evolution of our relationship" (36.5%). This is followed, with more modest values, by the reasons "to claim the legitimacy of same-sex unions" (7.2%) and "to make our relationship official in the family, at work, etc." (4.6%). Nine per cent celebrated the union (or other similar institution) abroad and subsequently transcribed it in Italy.

In almost all cases the family of origin and friends of people in civil union or formerly in union are aware of their current sexual orientation, but for some of the interviewees the decision to come out has generated a negative reaction from their parents. Mothers showed hostility or rejection in more than a fifth of cases (21.8%), to a greater extent for women (28.8% compared to 18.1% for men). The negative reaction of fathers was slightly lower (19.8%), with a higher incidence for men (20.4% vs. 18.7%). When the son or daughter was civilly united, the mother and father did not accept the partner as part of the family in 4.8% and 6.4% of cases respectively.

[2] The survey included questions about sex and sexual orientation. Gender identity was not disclosed.

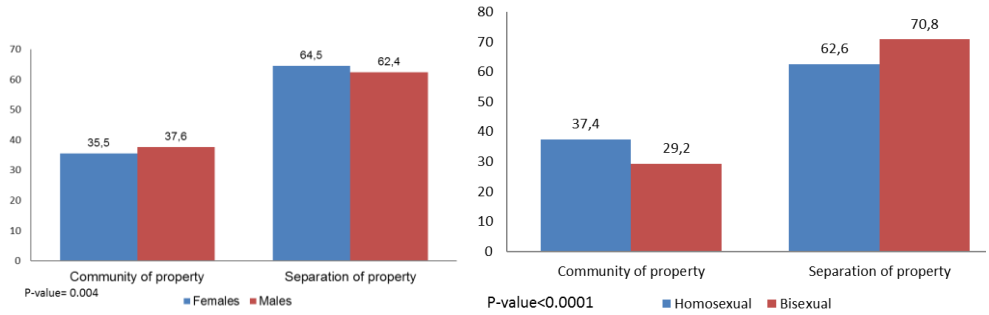
Looking at the property regime the survey shows that the community of property is chosen by 36.9% of homosexual and bisexual people in civil union (or formerly in union). More detailed descriptive analyses are presented in section 3.1, then the results of multivariate analysis are discussed in section 3.2.

3.1. Community of property among people in civil union

First, same-sex couples in civil union in Italy who choose to pool their economic resources are analysed by some social characteristics.

Data show that community of property is slightly higher among same-sex male couples and homosexuals (Figure 1-2). Men are likely to enter unions with more wealth than women: men in civil union are older on average, hence entered in the labour market and started earning and saving earlier compared to women.

Figure 1-2 – *Community of property by sex and sexual orientation. Percentage.*

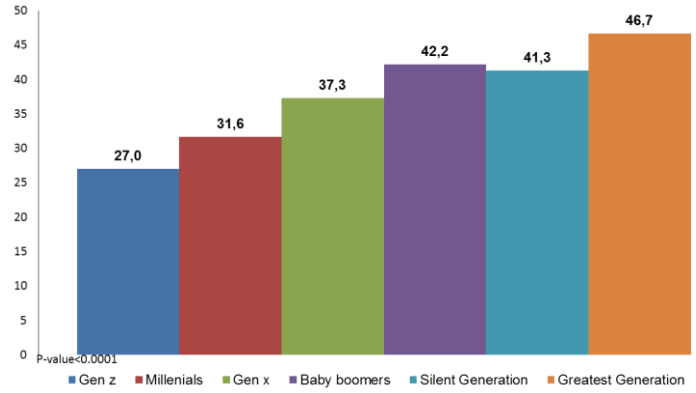


Source: Survey on Labour Discrimination against LGBT+ people in civil union. 2020-2021.

When we look at the age, we observe a linear trend whereby the communion of property decreases with the alternation of generations, with the exception of the Baby boomers. Community of property is chosen by 46.7% of Greatest generation (in civil union or formerly in union) and by 37% of Gen z (Figure 3). These results are in line with the cultural explanation that community of property is chosen for maintaining and consolidating individual identity and maintain autonomy.

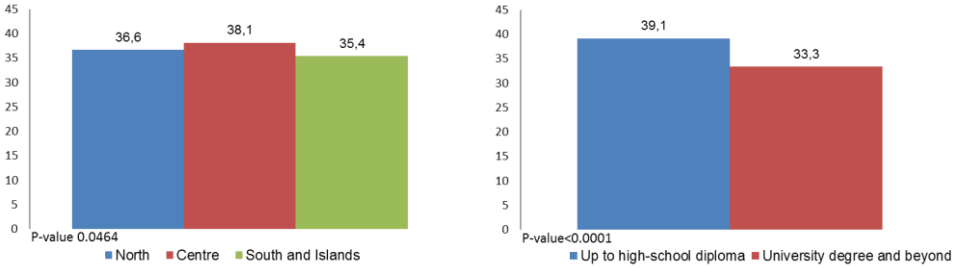
A higher share of community of property is observed among people living in the Centre-North, people with lower educational qualifications, unemployed and those working as employee (Figures 4-7). Data show that, on the one hand, pooling economic resources is chosen by people in a disadvantaged position and, on the other hand, by employees who have no risks associated with their job.

Figure 3 – *Community of property by generation. Percentage.*



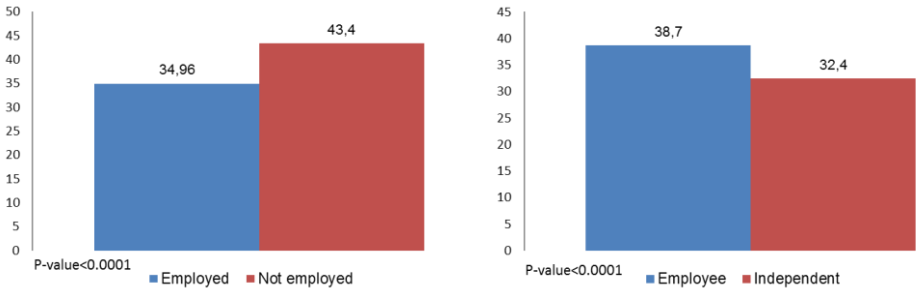
Source: Survey on Labour Discrimination against LGBT+ people in civil union. 2020-2021

Figure 4-5 – *Community of property by geographical area and education level. Percentage.*



Source: Survey on Labour Discrimination against LGBT+ people in civil union. 2020-2021

Figure 6-7 – *Community of property by employment status and type of job. Percentage.*

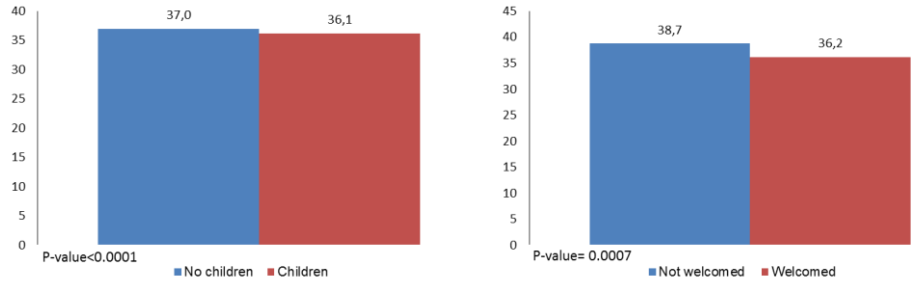


Source: Survey on Labour Discrimination against LGBT+ people in civil union. 2020-2021

Another important dimension taken into account is related to care responsibilities and having children. Our data show the community of property is more common among those who do not have children (biological and non-biological children, both of the respondent and of the partner, also when not legally recognised in Italy). Community of property is more common also among those who lived together before the union.

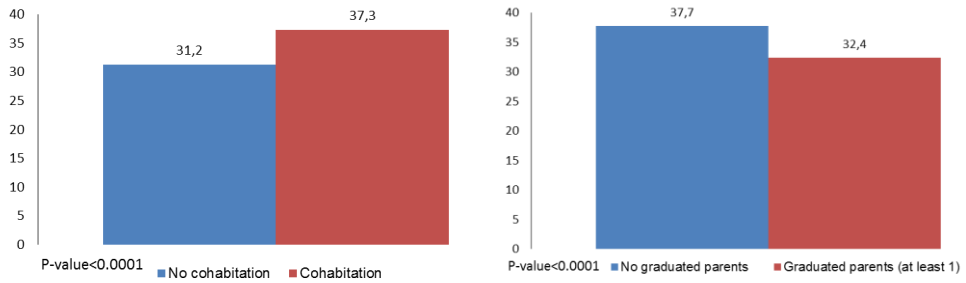
In order to consider the potential influence of the family of origin we analysed two specific questions of the questionnaire which inquired about whether, a son or a daughter was civilly united, their mother and father accepted or did not accept the partner as part of their family. When the family of origin did not accept the son/daughter-in- law, the percentage of community of property is higher (Figures 8-9). Similarly, it is higher for people with a lower cultural capital of the family of origin that indicates no parent with a degree (Figures 10-11).

Figure 8-9 – *Community of property by parental responsibilities and family support. Percentage.*



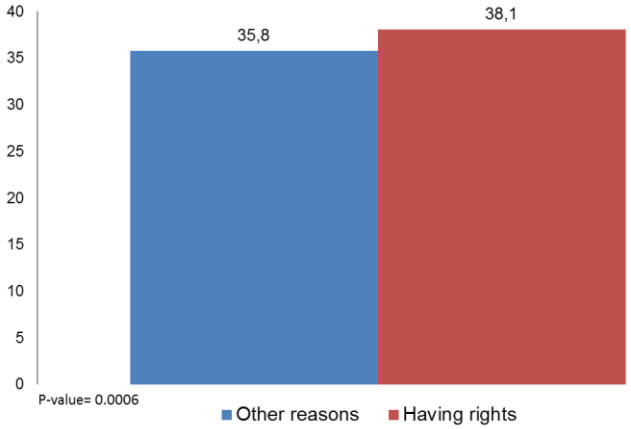
Source: Survey on Labour Discrimination against LGBT+ people in civil union. 2020-2021

Figure 10-11 – *Community of property by cohabitation or not and cultural capital of the family or origin. Percentage.*



Source: Survey on Labour Discrimination against LGBT+ people in civil union. 2020-2021

Figure 12 – *Community of property by main reason to choose the civil union. Percentage.*



Source: Survey on Labour Discrimination against LGBT+ people in civil union. 2020-2021

Another investigated dimension is the underlying reason to choose the civil union and their rights' awareness.

A question asked "What is the main reason that prompted you to the civil union?" and the possible items were: 1. it felt like the natural evolution of our relationship, 2. the civil union guarantees certain rights, 3. to formalize our relationship (in the family, at work, etc.), 4. to claim the legitimacy of same-sex unions, 5. other (Specify___), 6. I prefer not to answer. All these items are aggregated except that of claiming rights, in order to create the dichotomy.

Figure 12 shows that communion is more common among those who indicate as the main reason for the union the fact it guarantees certain rights. This may support the hypothesis of an attachment to a community logic and identification in the couple. Differently from what is hypothesized for heterosexual couples, this does not seem to be associated with a traditionalist context but with the claim of one's rights and willingness to support one another, even in the face of hostile contexts.

3.2. Community of property and main associated factors

The model that assesses the probability that a person in civil union chooses the community of property shows that sex is not a significant variable, as well as there are no significant differences by the geographical area in which a person lives and between those having the support of family e those and those who don't have it.

Table 2 shows the results of the estimation of the model.

Table 2 – *Probability that a homosexual or bisexual person in civil union chooses the community of property. Odds ratio.*

	Analysis of Maximum Likelihood Estimates			Odds Ratio Estimate		
Parameter	Estimate	Standard Error	P-value	Point Estimate	95% Wald Confidence Limit	
Intercept	-1.4637	0.1198	<.0001	-	-	-
Homosexuals	0.3286	0.0663	<.0001	1.389	1.220	1.582
Age	0.0124	0.0014	<.0001	1.013	1.010	1.015
University degree	-0.1847	0.0321	<.0001	0.831	0.781	0.885
Employed	-0.1997	0.0376	<.0001	0.819	0.761	0.882
Independent	-0.2987	0.0341	<.0001	0.742	0.694	0.793
Having children	0.1113	0.0543	0.0405	1.118	1.005	1.243
Cohabitation	0.3064	0.0647	<.0001	1.359	1.197	1.542
Graduated parents	-0.0934	0.0436	0.0321	0.911	0.836	0.992
Having rights	0.0678	0.0297	0.0223	1.070	1.010	1.134

Source: Survey on Labour Discrimination against LGBT+ people in civil union. 2020-2021

Being declared homosexual (rather than bisexual) increases the probability of choosing the community of property by 38.9%. Higher likelihood of choosing the community of property among those who lived together before the union, have children and have chosen the civil union because the union guarantees certain rights.

In addition, it can be observed that for each one-year increase in age, the probability of choosing the community of property increases by 1.3%.

Conversely, there is a lower likelihood of selecting this regime among more educated people, employed and independent workers.

4. Conclusions

This exploratory study is one of the first to analyse gender differences on property regime choice- in civilly united couples in Italy. It provides a first insight. We find no evidence about differences between male and female same-sex couples in civil unions when choosing the property regime. Gender seems to be not relevant.

The community of property is more common among homosexuals and older people. This may indicate that bisexuals choose separation of property more often to protect their children born from a previous relationship. Similarly, the youngest opt

for this regime due to their desire of individualization and autonomy, but also because they consider the possibility of a future divorce.

Overall, we thus found evidence that the characteristics for which people in civil union are more likely to choose the community of property are related to a higher awareness of claiming rights.

When we look at our results about a higher likelihood to choose the separation of property among the more educated, with more economic resources and independents workers, there may be various explanations, e.g. desire to maintain more autonomy and for independents also protecting the family assets from entrepreneurial risks.

This emerging field would greatly benefit from further studies gaining insights, for example, on the extent to which the unbalanced distribution of economic resources in a same-sex couple is a key factor when choosing the separation or community of property or on the main economic or cultural motivations for one option or the other. In line with this, further studies on same-sex couples as unit of analysis should be encouraged.

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AGEING AND FUNCTIONALITY IN THE PUBLIC ADMINISTRATION EMPLOYMENT: A CASE STUDY FOR THE ITALIAN MUNICIPALITIES[1]

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Abstract. This contribution deepens the theme of functionality and performance of a key segment of Italian Public Administration represented by municipalities. In the current historical phase, the importance of cities is reiterated by the National Recovery and Resilience Plan (PNRR), since these entities hold investments for just under 30 billion euros and should demonstrate planning ability, high efficiency, and effectiveness.
The first main aim of the paper is to analyze characteristics, trends, and outcomes of ageing workers on staff in the municipal administrations located in the Italian communes, a phenomenon related to a series of critical demand variables (demographic structure), service delivery (organizational models, digitalization), efficiency of provided services, degree of effectiveness associated with performance and citizen satisfaction.
A multisource and integrated approach is carried out based on the following official statistics: Public Institution Census survey conducted by Istat; Personnel indicators gathered by the Annual Account of Economic and Finance Ministry; Financial Statement Indicators gathered by municipalities.
The Input/Outcome model is applied, in which resources (input) should measure performance (output) and change (outcome), identifying dimensions and indicators to study the phenomenon of ageing and contraction in public sector occupancy.
A multidimensional analysis at the Italian level is carried out referring to municipalities classified by territorial localization, demographical dimension, and urbanization rate. Some personnel classification variables (such as age, gender, qualification) and balance sheet indicators have been elaborated to evaluate short term output and medium-long term outcome in municipal administrations. The results of this study highlight areas in which reactions to demographical and technological transformations in terms of organizational strategies reach critical values and those ones in which advantages could be found.
Some diachronic indicators are compared according to age, gender, and qualification for employment in the municipal administration at the commune level. Some data about qualification will allow to discover educational mismatches (cases where local administrations are covered by undereducated or overeducated personnel).

[1] The paper has been jointly written by all the authors but § 2 and 3 can be attributed to A. P. M. Mirto, § 4 to F. Gaudio, while § 1 and 5 to all the authors. MEF (Ministry of Economy and Finance) data have been processed by D. Maiolino and F.P. Rizzo. Maps in ArcGis have been created by F. P. Rizzo.

1. Introduction

To face the challenges of public administration, it is necessary to react to the demographic and technological changes in recent years with a new organizational strategy. Public Administration (PA) action deals with the development of the quality of human capital, aiming at the enhancement and strengthening of the knowledge and skills of employees (Inapp, 2021). In the light of growing ageing of the workforce employed in PA, it is necessary to reorientate personnel management policies in line with the definition of training.

Municipalities, the main beneficiaries of administrative functions as closer to citizens and more suitable to meet their needs, have a crucial role in using PNRR resources (CDP, 2022). As underlined by the European Commission, the administrative capacity of the Italian public sector must be strengthened to improve offered services and public investments (European Commission, 2021). Since 2008, policies to contain public expenditure have led to blocking of turnover, generating a decrease in number of employees; today percentage of public workers in total employment in Italy is lower than the OECD average (OECD, 2021).

Misalignment between available skills and those required by the production model for new generations (digital, ecological, and inclusive) is crucial evidence in public administration employment (Inapp, 2021).

The paper deals with the theme of functionality of employment in municipal administrations within Italian public sector, analysing and integrating different official sources (par. 2). The general framework of the input/outcome model helps to interpret the input component in which employment municipal data are represented.

Organizational municipal performance is a set of expected results of the administrations as a whole or the organizational units (PCM, 2017). It allows us to measure how the organizations, aware of the state of resources (health of administrations), uses the same in a rational way (efficiency) to provide services adapted to user expectations (effectiveness), ultimately to create public value, that is to improve the level of the social and economic well-being of the users (impact).

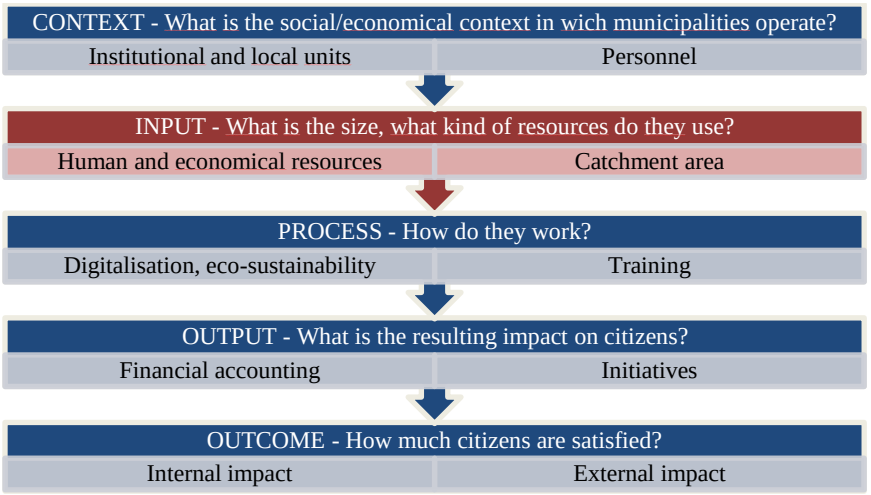
The main preliminary hypotheses of this paper refer to the contraction of public administration during the last decade, in terms of local units, personnel, and a number of atypical workers (Centro Studi innovazione nella PA, 2022; Istat, 2022). This reduction determines an increase of senior component as well as a reduction of new generation. Ageing in personnel is explained by the reduction of dependents, because of the high presence of senior component (OCPI, 2022 and 2019). Training is a crucial lever of the quality of human resources and shows great gaps between territories growing in the North and declining in the South and Islands.

An exploratory diachronic analysis has been carried out according to graphical and cartographical modules in 2021 and 2011 (par. 3). Finally, a composite index to evaluate municipal staff functionality by dimensions (ten elementary indicators) has been processed through Comic software (par. 4).

2. General framework and main sources

Input/Outcome model is applied as general framework to represent the functionality of municipal institutions (OCSE, 2021, Zamagni et al. 2015, Gori and Vittadini, 1999).

Figure 1 – *Conceptual framework: main indicators and official sources.*



Source: Elaborations on OCSE model.

Considering contextual information makes it possible to understand the major institutional differences and similarities among municipalities, and thereby helps to identify comparators for benchmarking purposes.

Input dimensions refer to the resources used by governments in their production function, as well as how they are mixed; on these resources analysis herein presented will be focused.

Process refers to the public management practices and procedures undertaken by the local governments to implement policies. These indicators quantify and qualify resources of the administration (human, economic-financial, instrumental, tangible and intangible) and assess the level of *administrative health*.

The dividing line between outputs and outcomes identifies outputs that refer to the amount of goods and services produced by the governments, while outcomes show the effects of policies and practices on citizens and businesses. A professional capable, and responsive public service is a key driver of citizens' trust in public institution (OECD, 2019).

Table 1 – *Characters of the main statistical sources on municipality data.*

SOURCES	KEY INDICATORS	MODEL COMPONENT	SPACE AND TIME
Public Institution Census survey - Istat	Local units, institutions, and personnel	Context	2017 and 2020, municipal level
	Activity volume/resources Obstacles to the digitization process Type of information security measures Participation training, IT training Sustainable behavior, social or environmental report	Process	
	Smart working impact Predicting minimum number of workers in attendance Digital channels available for users to use services	Outcome – internal impact	
Annual Account - Ministry of Economy and Finance	Staff with seniority > 20 and < 5 years Staff over 60 and under 40 years Replacement index of human resources Staff with low/high education Temporary staff Female staff	Input – Human resources	2010 and 2020, municipal level
Municipal Balance Sheet – Istat	Personnel Cost Administrative surplus (deficit) in relation to current revenue Incidence of capital transfers on capital expenditures	Input – Economical Resources	2011 and 2021, municipal level
	Spending rigidity Degree of dependence on central and local government	Output – Financial accounting	
Multipurpose Survey - Istat	Citizens' trust in municipal administrations Degree of user satisfaction with some services rendered by municipal administrations	Outcome – external impact	2020, regional level

The main official statistical sources exploited for the analysis of all model components are:

- *Istat Census on Public Institutions* - 2020 and 2017 data (referred to activities and organisation of institutional units, functionality of certain services, training

indicators, health and safety indicators, ICT, sustainability and transparency, tasks performed by local units, recipients of services provided by local units);
- *Balance sheets of public bodies* (revenue and expenditure, profit and loss account and balance sheet, budgetary indicators and staff data of institutional units);
- *Ministry of Economy and Finance (MEF) – Annual Account*: some indicators related to seniority, education, age, type of contract personnel on staff in municipal administrations;
- *Istat multipurpose survey on families*: the degree of satisfaction of users of some services provided by the PA (use of some means of transport, satisfaction with some aspects of the service, users length of line and judgment on time of services);
- According to the common European quality criteria and data availability some indicators have been selected and calculated for the Italian municipalities and a synchronic analysis has been referred to the demographical dimension, urbanization rate and spatial localization.

The degree of urbanization classifies entire territory of a country along an urban-rural continuum and combines the population size density thresholds to capture three mutually exclusive classes: cities, towns and semi-dense areas, and rural areas. The population classifies the municipalities in three classes chosen in this paper: under 5,000 inhabitants, 5,000-20,000 inhabitants and >20,000 inhabitants.

3. Main findings: descriptive analysis of elementary indicators

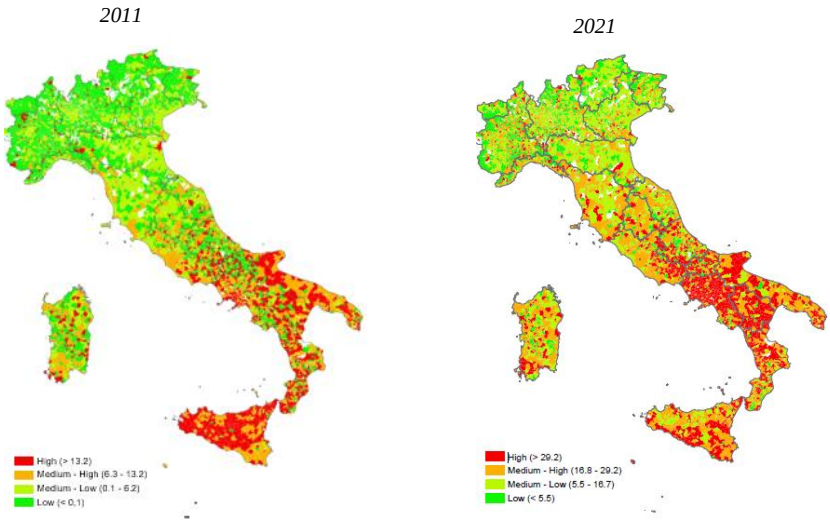
As mentioned before, personnel are the main resource of the public organizations; with ageing of population and increasing automation of process routine becomes greatly important anticipate strategic problems (European Commission, 2017). Specific opportunities for organizational development through the human resources include to plan its staff for improving its performance by engaging people with the right skills, to allow mobility within and between institutions for sharing know-how and developing flexibility and responsiveness, to manage learning networks and intergenerational learning, to implement recruitment policies, promotion and development based on competences and importance of lifelong learning.

Through the analysis of the main elementary municipality indicators, referred to the personnel on staff in municipal administrations, the following main outlines emerge[2].

[2] The MEF data referred to 2021 and 2011 are provisional and could be revised in future studies.

In 2021 the share of employees over 60 years old has increased in comparison to 2011 (from 7.3% to 21.4%, Fig. 2), especially referring to the southern region (except to Sicily) and more in the municipal administrations than in the other institutions (Istat, 2021).

Figure 2 – *Old age employees on staff in municipal administrations in Italian communes - 2011 and 2021(% values).*



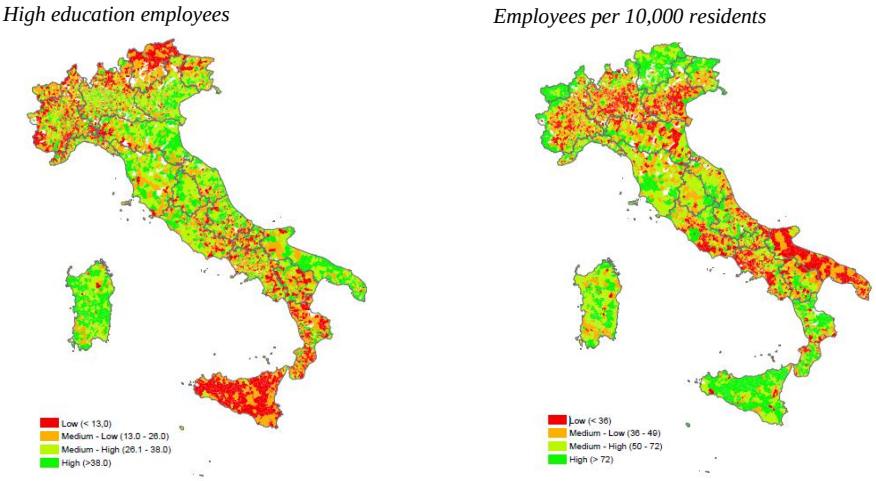
Source: Elaborations on MEF data.

The high education level (at least a bachelor's degree) seems to be critical in those areas where the number of employees per resident is higher (Fig. 3); it is increased especially in the Centre (from 21.7% to 35.1%); on the contrary the number of employees per 10,000 residents is decreased especially in the Centre (from 75 to 64 per 10,000 residents).

In 2021 trained employees have increased greatly in comparison to 2011 (also for presence of e-learning), especially in the northern regions (from 101.2% to 141.6%), more in the municipal administrations than in the overall institutions.

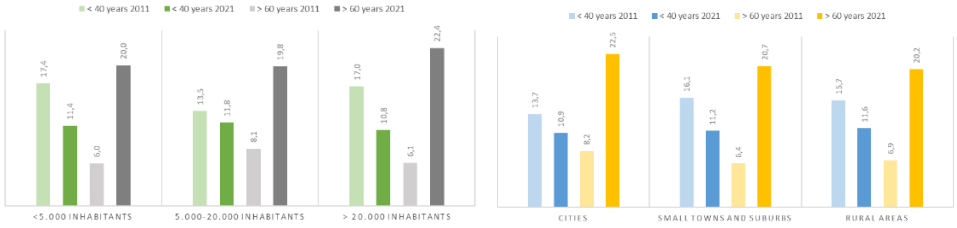
In the last decade, the average age of employees has increased by about 4 years. In some sectors, such as the municipal administrations, ageing was more pronounced at around 6 years (Aran, 2013); the share of senior component increases and young component decreases in all the classes by demographical dimension of the municipal administrations (Fig. 4); the share of employees over 60 increases in all urbanized and non-urbanized areas, on the contrary the young component decreases.

Figure 3 – *Employees on staff in municipal administrations: % high education employees and employees per 10,000 residents in Italian communes – 2021.*



Source: Elaborations on MEF data.

Figure 4 – *Young and old age employees on staff in municipal administrations per demographical dimension and degree of urbanization of Italian communes - 2011 and 2021(% values).*



Source: Elaborations on MEF data.

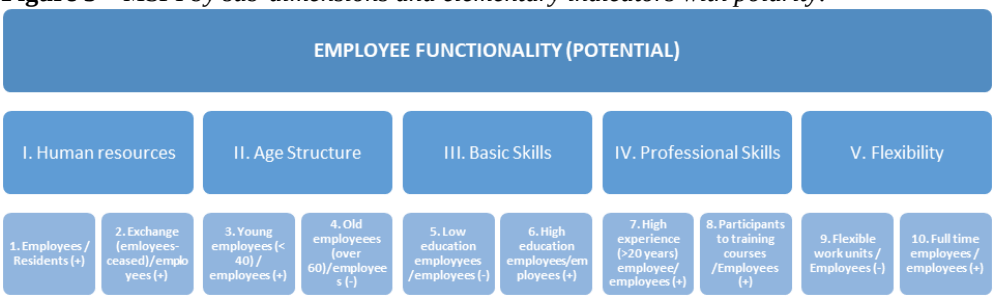
4. A composite index for municipality human resource

Ten elementary low correlated indicators have been selected to build a composite Municipal Staff Functionality Index (MSFI), linked to the quality and level of human resources (Fig. 5). It has been processed by Comic Software[3] selecting, according to the methodological choices, AMPI – Adjusted Mazziotta-Pareto Index (Mazziotta,

[3] For further details see the Composite Indices Creator - https://www.istat.it/it/metodi-e-strumenti/metodi-e-strumenti-it-per-la-produzione-statistica/analisi/strumenti-di-analisi/comic.

Pareto, 2020 and 2017, OECD 2008, Alaimo, 2022). Referring to the formative approach, the elementary measures have been selected following a logic of causality with respect to the phenomenon of interest - a low level of mutual correlation between these measures was confirmed[4]. The municipality distribution by quartiles shows more critical areas in the southern regions, especially in 2021[5].

Figure 5 – *MSFI by sub-dimensions and elementary indicators with polarity*.



In 2021, in the I quartile there is a higher share of employees per resident (62.4% versus 56.0% in the IV quartile), but with a less stable (ind. 9) and a lower share of full-time employees (ind. 10). In addition to a more stable and balanced composition in terms of age, the municipalities in the IV quartile also have a higher level of (formal) skills of their employees, both due to more than double incidence of tertiary degrees (38,2% in the IV quartile versus 14.0% in the I quartile) and very small share of those below secondary school graduation (10.0% in the IV quartile versus 33.5% in the I quartile).

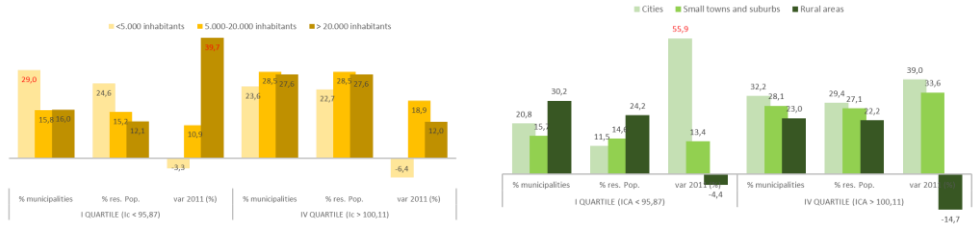
The level of education appears to be generally increasing, but more pronounced in the "virtuous" municipalities. Here, the specific professional skills are also visibly more robust, both in terms of field experience (47.1% in the IV quartile versus 36.3% in the I quartile) and more frequent use of in-service training activities (144.3% in the IV quartile versus 31.7% in the I quartile[6]). Finally, the municipalities in the IV quartile are characterized by a lower incidence of the atypical forms of employment such as flexible work contracts (in the IV quartile 4.6% versus 9.6% in the I quartile) and full-time work (91.7% in the IV quartile versus 53.9% in the I quartile) reporting a low, decreasing or at most stable incidence.

[4] The values of correlation index were found to be systematically below or at most close to +/-0.35: this results in a level of correlation contained within acceptable thresholds.
[5] It was compiled on 7,593 municipalities, a largely majority statistical base and substantially identical for the two years and average for Italy relative to base year was considered as benchmark, which was given a value of 100.
[6] The value refers to in-service training and may be greater than 100 because participation in training activities during a year may be repeated for each employee.

These functional profiles tend to take on different connotations with reference to the socio-territorial classification variables herein considered: population scale; urbanization; geographic localization.

Referring to the first two factors-which delineate strongly interrelated typologies[7]-seems to highlight a level of functionality in terms of size and composition (biographical, skill set, professional) of workforce, which tends to decline especially in the smallest and less urbanized realities (Fig. 6). Just under a third of these cases-where, however, about 1 to 4 Italians will reside in 2021, and thus present a potentially significant demand for municipal services-are in the I quartile, with a visibly higher frequency in medium-large municipalities and with an urban connotation. The latter are relatively more present in the IV quartile, that is, in the most virtuous component of employee functionality.

Figure 6 - *Municipalities and population in the I e IV quartile for MSFI by dimension and degree of urbanisation. 2021 and % var. 2021/2011.*



Source: Elaborations on MEF data.

Figure 7 – *Young and old age employees by MSFI quartiles – 2011 and 2021*

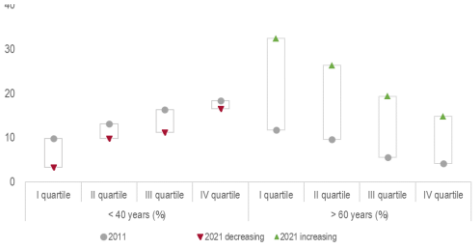
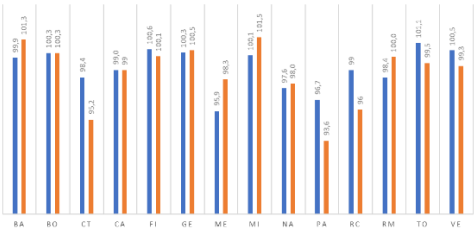


Figure 8 – *MSFI in metropolitan cities – 2011 and 2021*



Source: Elaborations on MEF data.

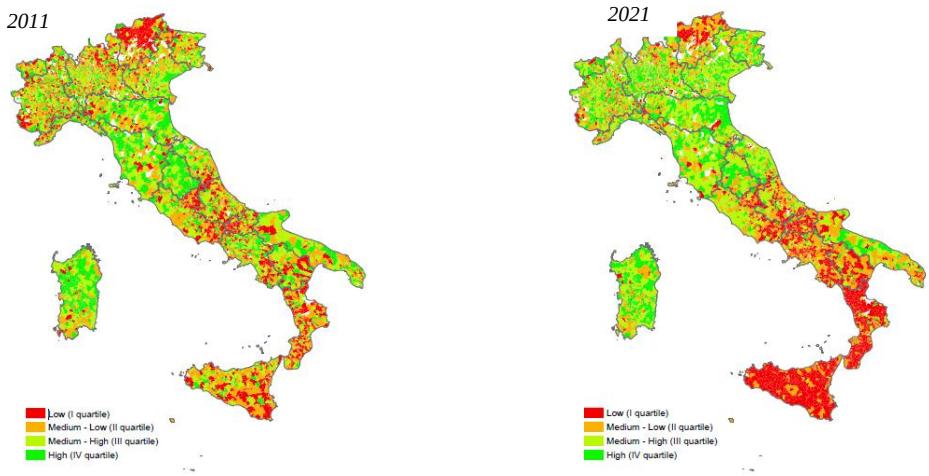
[7] In general, the two variables are significantly correlated: as population size increases, so does the degree of urbanization. About 85% of municipalities with a population of less than 5 thousand fall into the rural area classification, slightly more than 76% of the 5-20 thousand class fall into the grouping of small towns or suburbs, and more than one-third of the higher size fall into the grouping of densely populated areas.

Prevalence in the I quartile of old age component above all in 2021 (32.4%); relevance in the IV quartile of young component in the decade (18.3%, Fig. 7).

In 2021 MSFI for metropolitan areas shows the highest value in Milan (101.5) and the lowest one in Palermo (93.6), while in 2011 Torino has the highest value (101.5) and Palermo again the lowest (96.7, see Fig.8).

The highest percentage of municipalities belonging to the I quartile is in the southern area (49.4%, Fig. 9); on the contrary the highest percentage of municipalities belonging to the IV quartile is in the North (34.1%). Calabria and Sicily show the most critical by far, both in terms of composition and trend. Lazio region has a structure very similar to the South, while the Sardinia is closer to the virtuous cases in the North-Center. The regions of so-called Third Italy (Center-North-East), report very virtuous profiles; an exception is the case of Trentino Alto Adige, which is worthy of further study (Putnam, 1993). The Alto Adige area is influenced by a moderate value of some indicators like full time employees (linked may be to seasonal workers) that demonstrates the model should be adapted to different realities with some adjustments (on the contrary in Sicily critical value of the indicator could be influenced by increasing presence of socially useful workers).

Figure 9 – *MSFI by municipality - 2011 and 2021.*



Source: Elaborations on MEF data.

The representations plastically render the image of persistence and strengthening of traditional dualistic pattern of territorial gaps in Italy, with the South lagging far behind on this front as well. This pattern tends to become more pronounced in the most recent phase, when there is a shift from a "patchy" to a broader and "tendentially

systemic" spread of the problematic situations outlined by the functionality indicator in these territories, in contrast to a positive trend in the North-Centre (Istat, 2023).

5. Final perspectives

The level of demographic and technological change stimulates an acceleration in building an advanced PA model, capable of responding to the growing demand for qualified services from the community. It is essential to rethink roles and professional profiles, systems of assessment of skills in a perspective more oriented to soft and transversal skills (Inapp, 2021).

The ability to carry out a transformation induced by increasing digitalization encounters an obstacle in current demographic structure of public employment; ageing of employees is a widespread phenomenon within the municipal administrations: it characterises the picture with a predominance of cohorts of over 60 years matched with a very thin presence of young cohorts, both in urbanised and rural areas, in big cities and small towns, in every territorial context but especially in the South.

The reduction of financial resources destined to training has damaged the quality of human capital, while the practices of seniority management to favour circulation of intergenerational learning are still not very widespread.

Ultimately, the municipalities in the southern areas - although characterized by a broader demand for important public services (urban planning, waste, civil protection, social services, local police, etc.), and not specifically attended to by the cohesion policies of recent years - typically present weaker staffing levels, perhaps thicker but with a lower degree of progressively older and with relatively weak basic and in-service skills. Whether and how much these aspects affect activities and outcomes, persisting over time, will be the subject of subsequent investigations aimed at further enhancing official statistical production in the sector.

Another crucial issue to deepen is possibility to explore the other model components (process, output, and outcome) for evaluating segment of municipal administrations as well as other institutions belonging to public administration sector. So MSFI could be considered a potential functionality index since the model does not cover variables of process and outcome. The subsequent implementation of a similar outcome measure in the design phase may enable a more complete assessment of the weight of employees on the effectiveness and efficiency of the municipal administrations.

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US FERTILITY THROUGH THE LENS OF GRAPHICAL CAUSAL MODELS[1]

Giambattista Salinari, Gianni Carboni, Gustavo De Santis, Federico Benassi

Abstract. This article explores the application of the Structural Causal Models (SCM) approach in the field of demography, discussing the PC algorithm to identify the causal chain, and the backdoor criterion, to identify the variables that need to be controlled for. Using a subset of the Panel Study of Income Dynamics (PSID) dataset, we applied the SCM approach to investigate the causal effects of women's age at first child on completed family size and household income, with the aim of simulating potential interventions designed at promoting an earlier onset of fertility. We found contrasting effects: inducing women to have their first child one year earlier could result in a 5% increase in their completed fertility, but it would also lead to a 4% reduction in their household income.

1. Introduction

The 1920s represented a turning point in the history of causal inference. During this decade, Ronald Fisher (1926) developed the idea of randomized experiments, today considered the most reliable method for causal inference, and Jerzy Neyman (1923), in his PhD dissertation, proposed a mathematical notation allowing for the rigorous treatment of causality. Around the same period, Sewell Wright (1921, 1934) proved that it was possible to represent causal dependencies among a set of variables using a graph where variables are represented as nodes and causal links as arrows (edges). Wright also showed that, in a linear system, it is possible to estimate the causal path coefficients following a set of simple rules.

About 50-60 years later, these seminal papers led to the development of two different approaches to causal inference. The first, based on the work of Fisher and Neyman, was developed in the field of statistics by Donald Rubin (2015) under the name of Potential Outcome Framework (POF). The second approach, developed by Judea Pearl (2009) in the field of computer science, expanded on Wright's original

[1] Giambattista Salinari was the progenitor of the core idea and provided methodological expertise for the study. Gianni Carboni was responsible for data curation and preparation, ensuring robustness and integrity in the analytical process. Gustavo De Santis and Federico Benassi contributed significantly through providing overarching critical feedback and refining the manuscript with insightful conceptual enhancements.

idea of representing causal dependencies using graphs, and introduced the concept of Structural Causal Models (SCM).

The two approaches are perfectly consistent, as a theorem developed by Pearl proves. However, they pursue partially different goals. Broadly speaking, causal inference faces two fundamental problems. First, it is necessary to establish whether a given causal question can be answered unambiguously using available data. For example, it can be proved that in a randomized experiment, the question about the existence of a causal effect of the treatment (e.g., aspirin) on an outcome (e.g., headache duration) can be answered univocally. This problem is known as *identification*. At that point, a second problem arises, known as *estimation*: measuring the causal effect of interest from a finite sample.

The POF and the SCM approaches differ, in our view, in the relative importance they attribute to these two problems: SCM focuses primarily on identification, whereas POF is mainly concerned with estimation. In short, the two approaches can be considered as complementary.

Another difference is in the fields of applications. POF has been widely applied in the social sciences, where SCM has been relatively neglected, despite its potentialities. For instance, it proves helpful in highlighting causal structures, and in the last 20-30 years, many algorithms have been developed in the SCM field to automatically identify causal connections between variables in a dataset, the so-called causal structure. Verma and Pearl, back in 1990, were the first to propose an algorithm with this purpose, called inductive causation (IC). Despite its limitations (the method is slow and inefficient), the algorithm has the merit of showing that it is possible to derive a causal structure from purely observational (non-experimental) data. Within limits, of course, as Verma and Pearl (1990) themselves pointed out. Depending on the characteristics of the underlying causal structure (to be discovered), the *direction* of some causal connections cannot be determined from observational data alone, even with an infinite set of observations. In these cases, the direction of causality can be determined only through randomized experiments, or based on a-priori, background knowledge, or by introducing assumptions. For example, if the IC algorithm cannot establish the direction of the causal connection between gender and income, we can conduct an experiment where we artificially increase the income of randomly selected individuals with the aim of observing whether this intervention leads to a change in their gender. Alternatively, we can rely on our background knowledge to conclude that a causal effect of income on gender is unlikely: the true causal connection goes the other way.

After IC, several other algorithms were proposed in the literature. The PC algorithm for instance (after its inventors Peter and Clark) is an improved – faster and more efficient – version of IC (Spirtes et al. 2000). Today, both the IC and PC algorithms are considered part of a broader class of learning algorithms known as

constraint-based algorithms, which involve local testing of causal connections between variables.

An additional advantage of the SCM approach is the possibility of automating the search for the solution of the identification problem. Imagine that the causal structure of a dataset has been identified (e.g. via PC) and that we are interested in particular in the causal effect of X on Y (both variables). One of options offered by SCM is the now well-known *backdoor criterion* (Pearl 2009), which allows researchers to identify the set of causal variables, excluding "bad controls". For example, if X and Y share a common *cause* Z, the backdoor criterion will indicate the need to control for Z to correctly estimate the causal effect of X on Y. However, if Z is a shared *effect* of X and Y, the backdoor criterion will indicate that no control is necessary (keeping in mind that controlling for Z in this case could bias the results, introducing a spurious association between X and Y).

The backdoor criterion is sufficient, but not necessary and sufficient. When its conditions are satisfied, the identification of a causal effect is possible. However, there are contexts where, although the conditions for the backdoor criterion are not satisfied, the causal effect can still be identified using more advanced criteria, such as those provided by the *do-calculus*. The do-calculus has been shown to be complete, meaning that if a causal effect is identifiable, it can be demonstrated to be so using the do-calculus.

If a given causal effect can be identified, it can be estimated with several different methods: regression analysis, inverse probability weighting, matching etc.

To conclude, with the SCM approach, the computation of a causal effect can be broken down into three distinct phases:

1. Discovery of the causal structure;
2. Identification of the causal effect of interest;
3. Estimation.

In this paper we apply the SCM approach to answer two questions related to fertility in the US, and in particular to the causal effect of a woman's age at first birth: a) How does it affect completed family size? b) How does it affect lifetime income?

2. Causal discovery

For our analysis, we used the Panel Study of Income Dynamics (PSID) (Survey Research Center, Institute for Social Research, University oùf Michigan, 2022), a comprehensive US longitudinal dataset launched in the 1960s.

The PSID is a long-running, national panel survey of American families that collects data on economic, social, and health aspects. It is a valuable resource for researchers studying income dynamics, family structure, and other demographic variables. It has achieved a remarkably high wave-to-wave re-interview response rate of more than 90%. This rate indicates the percentage of participants who continue to participate in each successive wave of the study. The PSID started in 1968: as of 2019, 41 waves of data collection were carried out, highlighting a wide range of factors affecting the well-being of American families.

We focused on a subset of the PSID, known as the Childbirth and Adoption History dataset, with fertility information on more than 50,000 individuals of both genders. This data was subsequently integrated with an array of ancillary sub-datasets, encompassing a wide spectrum of demographic and socioeconomic variables, both at the household and individual levels. This integration facilitated a comprehensive reconstruction of individual life trajectory. For our study we retained only women whose fertility history was known for the ages between 20 and 45 years. This allows us to analyze sufficiently long fertility histories without limiting too much our sample size. Of course, something gets lost in the way, such as the possibility to investigate phenomena such as teen pregnancies.

This selection process left us with 2,531 women, for whom we retrieved also additional information from other sections of the PSID, creating the following variables (all referred to Ego, i.e. each woman in our sample):

- *Children*: Number of Ego's biological children (ever had).
- *Year*: Ego's year of birth.
- *Ethnicity*: Ego's ethnic group.
- *ChildhoodIncome*: Ego's past economic situation (when they were young).
- *EduExp*: Total education expenditure in Ego's household.
- *Siblings*: Number of Ego's siblings.
- *AgeCh1*: Ego's age at first birth.
- *RelStatus*: The proportion of years (age 20 to 45) Ego lived with a partner.
- *EmplStatus*: The proportion of years (age 20 to 45) Ego had a payed job.
- *IncomePre*: Ego's household income in the year preceding the first birth.
- *IncomePost*: Ego's household income after the birth of the first child.

Our purpose is to detect a possible causal relationship between these variables. We employed the PC algorithm, which works under three main assumptions:

1. Reverse causality is not allowed (no loops):
2. There are no hidden confounders;
3. The joint probability of the variables in our dataset is stable (faithful).

The first condition states that it is not possible for a variable to be both cause and effect of any other at the same time. The key emphasis here is on simultaneity. Feedback processes are allowed, but it is crucial that causal effects, if any, take place in different periods. For example, income measured prior to the start of reproduction may influence the age at first child, and this can affect later income (for instance, parents with higher incomes may want to delay reproduction not to harm their careers). Feedback of this type can be represented without loops; in fact, it suffices to distinguish between two types of income, before and after the birth of the first child:

$$\text{IncomePre} \rightarrow \text{AgeCh1} \rightarrow \text{IncomePost}$$

According to the second assumption there must be no omitted variable that causally affects at least two variables in our dataset, where "omitted" means that this variable is not included in our dataset.

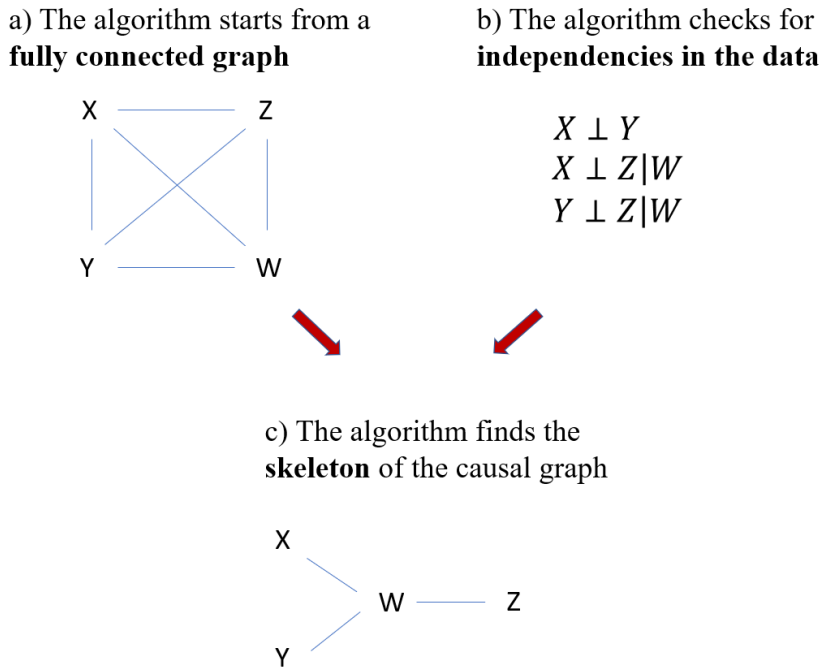
Note that this assumption is only provisional. Based on our current knowledge, all the relevant variables are included in the dataset to which we apply the PC algorithm to infer its causal structure (local Markov condition). Of course, if some relevant variable is missing, the resulting causal structure may be biased. However, this is not overly concerning because further analyses may later reveal that some extra variables should be considered. In other words, the causal structure is learnt through an incremental process, wherein the Markov condition is assumed to hold until proof of the contrary.

The third assumption states that some rare situations such as those occurring in a Simpson's paradox do not affect our data (on this, see Spirtes et al. 2000).

Based on these assumptions, the PC algorithm systematically checks for independence in the relationships within our dataset. The logic behind it is that a direct causal connection between two variables exists only if they cannot be rendered independent by conditioning on all possible subsets of the remaining variables. In simpler terms, if two variables, X and Y, can be made independent of each other by conditioning on a subset **Z** of the remaining variables, a direct causal link between X and Y is excluded.

The PC algorithm initially assumes that all variables are causally linked (Figure 1a). It then proceeds to identify the independence relationships between the variables in the dataset, as depicted in Figure 1b. This is done with the help of standard statistical tools such as the chi-squared test of independence or the likelihood-ratio test. In the case of linear systems, linear regression and vanishing partial-correlation coefficients can also be used. In the example of Figure 1, we assume that three independence relationships emerge: 1) X and Y are marginally independent ($X \perp Y$); 2) X and Z are conditionally independent given W ($X \perp Z|W$); and 3) Y and Z are conditionally independent given W ($Y \perp Z|W$).

Figure 1 – *The PC algorithm finds the skeleton of the causal structure.*

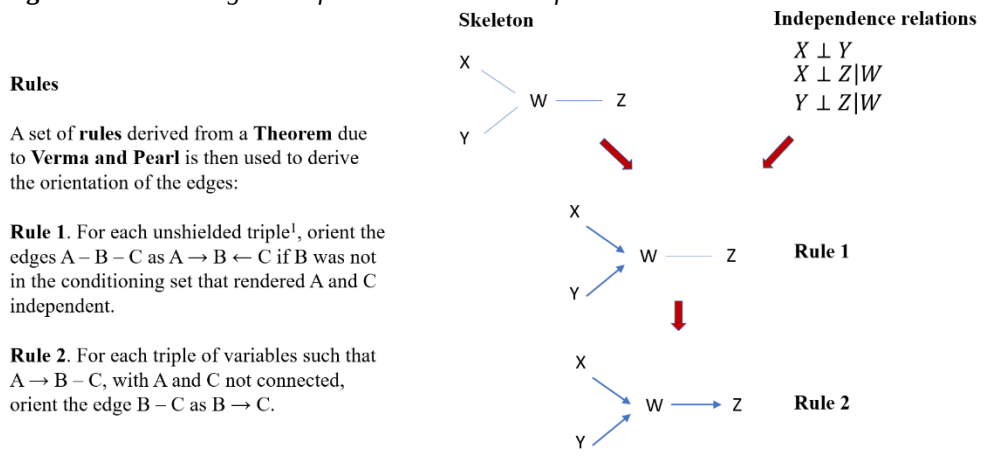


Since two variables cannot be directly connected if they are found to be marginally or conditionally independent, in Figure 1c we simply remove the edges between X and Y, X and Z, and Y and Z from our original graph. This results in the "skeleton" of the causal structure, where the causal links are represented without their orientation (the arrowheads).

In its final step, the PC algorithm determines the orientation of the edges in the skeleton applying a set of rules derived from a theorem developed by Pearl and Verma (1990), as depicted in Figure 2.

Eventually, PC concludes that the only causal structure consistent with the observed independence relationships in our dataset is that shown at the bottom of Figure 2, where both X and Y cause W, and W causes Z. In this example, the PC algorithm successfully orients all the edges of the skeleton, but this is not always the case. There may be situations where the correct orientation of these causal connections cannot be derived from observational data alone.

Figure 2 –*The PC algorithm finds the orientation of the causal links*[2]



As said, the PC algorithm can be broken into two distinct phases: a) finding the skeleton, and b) orienting the edges. While the first phase generally produces stable and reliable results, the second phase may not (Spirtes et al. 2000), because the number of possible causal structures increases super-exponentially with the number of nodes. For example, with a set of 10 nodes (variables), there are approximately 4.2×10^{18} different possible causal structures, which increases the likelihood of picking up the wrong structure. This problem can be mitigated by narrowing down the search space, i.e. by incorporating background knowledge. In our case, for instance, the year of birth and the ethnic group of a woman are two "root" nodes in our graph, that is, variables that cannot be influenced by any other. Therefore, if there is a causal connection with, let us say, education, the direction must be from these

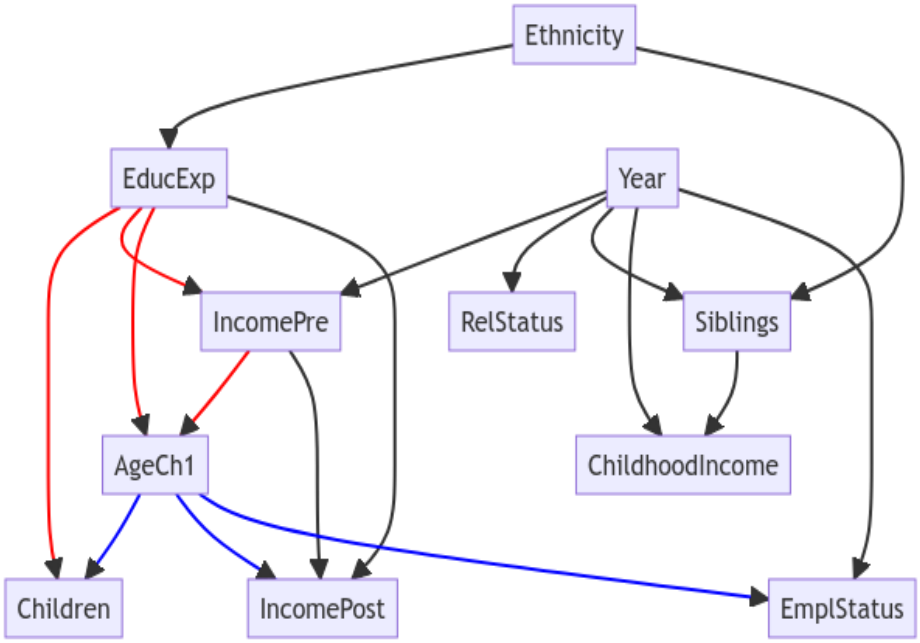
[2] Consider the triple A, B, C; this is referred to be unshielded if and only if A is adjacent to B (A–B), B is adjacent to C (B–C), and A is not adjacent to C (A C) Then A–B–C is an unshielded triple.

two variables towards education, and not vice versa. This type of information can be added to the algorithm in the form of a blacklist of prohibited causal connections.

This restricts the search space for possible causal structures, enhances the reliability of the results, and makes the Structural Causal Model (SCM) approach particularly promising in the field of social science. As actors in the social structure, we naturally possess a significant amount of background knowledge about the phenomena under study. In some cases, such as fertility for instance, the variables are naturally ordered by age, which guides the orientation of edges in the causal graph.

In our dataset, we were able to specify a set of 41 prohibited causal links, which guided the PC algorithm[3] in the discovery of the causal structure depicted in Figure 3.

Figure 3 – *The causal structure produced by PC using PSID data.*



[3] To recover this causal graph, we employed the bnlearn library of R. This library includes many different functions for recovering a causal structure. In the present case, we used the pc.stable() function (originally part of the pcalg library of R).

3. Causal effects identification and estimation

Below-replacement fertility is an issue in almost all advanced economies, and pro-natalist policies of some kind are frequently advocated. One among these involves lowering age at first birth. Would that be effective? To answer this question, we need to estimate the causal effect of the age at first birth on the total number of children.

To identify the causal effect of AgeCh1 (the treatment) on Children (the outcome), we begin by eliminating from the causal structure of Figure 3 all the edges emitted by the treatment (in blue). These edges are removed because they are the beginning of a series of paths through which the genuine causal effect flows. The attention then shifts to the remaining five paths that connect the two variables, as these are the paths that can potentially produce a spurious (non-causal) association between the treatment and the outcome. Two of these paths are of particular interest (in red in Figure 3):

$$\text{AgeCh1} \leftarrow \text{Edu.} \rightarrow \text{Children}$$
$$\text{AgeCh1} \leftarrow \text{IncomePre} \leftarrow \text{Edu.} \rightarrow \text{Children}$$

These two paths are classified as active (or open or unblocked) by the backdoor criterion, indicating that a bias is flowing through them, as the variable Edu. (EducExp) influences both age at first birth and the overall number of children. In other words, Edu. is a common cause, of the treatment and of the outcome, which qualifies it as a confounder. We must therefore control for Edu., netting out the spurious associations it may trigger. Surprisingly enough, in our case, this is the only control that is needed. This happens because in the three remaining paths connecting the treatment (AgeCh1) and the outcome (Children):

$$\text{AgeCh1} \leftarrow \text{IncomePre} \rightarrow \text{IncomePost} \leftarrow \text{Edu.} \rightarrow \text{Children}$$
$$\text{AgeCh1} \leftarrow \text{IncomePre} \leftarrow \text{Year} \rightarrow \text{ChildInc.} \leftarrow \text{Siblings} \leftarrow \text{Ethn.} \rightarrow \text{Edu.} \rightarrow \text{Children}$$
$$\text{AgeCh1} \leftarrow \text{IncomePre} \leftarrow \text{Year} \rightarrow \text{Siblings} \leftarrow \text{Ethn.} \rightarrow \text{Edu.} \rightarrow \text{Children}$$

we always find a collision node (or collider), that is a node influenced by two other variables (the collision nodes are respectively: IncomePost, ChildhoodIncome, and Siblings). Pearl showed that the presence of a collision node deactivates that path, through which, therefore, no spurious association flows.[4]

We conclude that controlling for EducExp is sufficient to block all the confounding paths connecting AgeCh1 and Children.

[4] The set of variables to be controlled for (the adjustment set) can be automatically detected. In the present case we used the dagitty library of R. dagitty is also available online at the following link: http://www.dagitty.net/.

We can now proceed to estimate the casual effect of interest through a Poisson model (because the outcome, Children, is a count variable):

$$log\big(E(Y|x,z)\big) = \beta_0 + \beta_1 x + \beta_2 z, \quad (1)$$

where Y represents the number of children, X is the age at first child, and Z is the variable EducExp (Table 1). Our estimates indicate that a delay of one year in the age at first birth entails a 5% reduction in the overall number of children.

Table 1 – *Estimate of the causal effect of AgeCh1 on EducExp*

Coeff.	Estimate	SE	z	Pr(>|z|)
Intercept	1.806e+00	6.350e-02	28.442	< 2e-16
AgeCh1	**-4.100e-02**	2.911e-03	-14.084	< 2e-16
EducExp	1.765e-05	3.579e-06	4.933	8.09e-07

However, this analysis is somewhat incomplete. Let us also assess the possible causal effect of AgeCh1 (the treatment) on IncomePost (the outcome). The (backdoor) procedure is the same as before, and it tells us that it is necessary to control for both EducExp and IncomePreChild1 (because these two variables represent shared causes, or confounders, of both treatment and outcome).

This time the causal effect of interest can be estimated by mean of a linear model given the continuous nature of the response variable:

$$E(Y|x,z_1,z_2) = \beta_0 + \beta_1 x + \beta_2 z_1 + \beta_3 z_2, \quad (2)$$

where Y represents the log-income after the birth of the first child, X is the age at first birth, Z_1 the cost of education, and Z_2 income before the beginning of the reproductive phase. The estimates of this model are shown in Table 2. Age at first birth has a positive effect on post reproductive income, and lowering by one year the age at first birth causes a 4% reduction in the income measured after the birth of the first child.

Table 2– *Estimate of the causal effect of AgeCh1 on IncomePost*

Coeff.	Estimate	SE	z	Pr(>|z|)
Intercept	1.806e+00	6.350e-02	28.442	< 2e-16
AgeCh1	**-4.100e-02**	2.911e-03	-14.084	< 2e-16
EducExp	1.765e-05	3.579e-06	4.933	8.09e-07
IncomePre	1.787e-05	1.036e-06	17.25	<2e-16

In short, policies aimed at promoting an earlier onset of fertility, if successful, are likely to have two effects. On the one hand, they do increase fertility, as desired (+5% for every year of fertility anticipation); on the other, however, they tend to depress income, by 4%. Individuals may be unhappy with the latter consequence and refuse to comply with pro-natalist (anticipation) policies, unless additional interventions are foreseen to offset income reduction.

4. Conclusion

The main purpose of this paper is to unveil the potentials of the SCM approach in social studies and policy interventions. We presented an example where we simulated an intervention which induces an earlier onset of reproduction. While possible, this intervention may have unintended and undesired consequences, such as a decrease in post-reproductive income.

We presented a very simple case in this paper, but similar analyses can be conducted on a larger population, including males and employing a broader set of variables, among which personality traits, childhood economic conditions, job uncertainty, gender equity, personal aspirations, and several others, all of them, ideally, collected longitudinally, so as to preserve the dynamic nature of these relationships. In this case, the SCM approach offers a powerful identification tool, the "sequential backdoor criterion", which enables the identification of the effects of time-varying causes on time-varying outcomes. The graphical framework developed by the SCM approach can thus prove especially useful in a life course perspective, currently emphasized in most demographic and social science research.

It should be noted that the primary objective of this paper was to compute Average Causal Effects (ACE). In other words, our focus was on calculating the mean effect across all individual causal effects. Nevertheless, it is crucial to acknowledge that causal effects may vary within specific segments of the population. For example, the anticipation of fertility might have a more significant impact on completed family size for couples who are “family-oriented” rather than “work-oriented”. Characteristics such as being “family-oriented” or “work-oriented”, which modify the causal effect of the treatment, are referred to as “effect modifiers”. Identifying these effect modifiers is essential for policy design, as they facilitate the targeting of interventions to segments of the population that are more responsive to the treatment. Structural Causal Models (SCM) offer various tools to ascertain the existence of such effect modifiers (see Pearl 2009).

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LONGEVITY: A FAMILY MATTER? INSIGHTS FROM AN INLAND VILLAGE OF SARDINIA (ITALY), 1850–2010[1]

Luisa Salaris, Nicola Tedesco

Abstract. Familial transmission of longevity is a primarily studied topic in human longevity research. The contribution of the genetic component inherited as part of the shared family DNA is hard to disentangle from that of the familiar environment. Based on the analysis of a genealogical database of an in-land village in Sardinia, this study aims to provide insights into the possible role of familial transmission of survival, estimating the effects of parental loss and parental longevity in two significant moments of individual life: in early childhood and at older ages. Using event history methods, survival trajectories of individuals born during the period 1850-1910 in a village of Sardinia (Italy) were analysed. It emerged that effects of parents' survival occur both in the short and long term. Mother's death before five years of age increases the mortality rates of the offspring, which are mitigated by the presence of at least one sister who can replace her in the care tasks. At older ages, only maternal survival is significant for Ego's longevity. The findings point to the relevance of the genetic component. Still, it suggests reflecting on the importance of the social dimension, the possible role of care and the transmission of knowledge and cultural capital, and social networks.

1. Introduction

Studies focusing on the relationship between familial transmission and individual survival are innumerable, all to understand the mechanisms by which genetic heritage transmitted from parents to children acts on survival, both concerning biological characteristics, the possible relationship with diseases, and longevity (see among others, Kerber *et al.*, 2001; Perls *et al.* 2007; You *et al.* 2010; O'Brein *et al.*, 2018; van den Berg *et al.* 2017; 2018). However, members of the same family also share the family environment, namely specific household characteristics, daily

[1] Luisa Salaris contributed to the study supervision, conceptualization, investigation, writing-original draft, writing-review & editing, interpretation, and discussion of results. Nicola Tedesco worked at conceptualization, interpretation of results, writing-review. All authors read and approved the submitted version.

habits, diet, the physical environment and climate, everyday experiences, and so on (Salaris, 2010; Jarry *et al.*, 2012; Iachine *et al.*, 1998). Genetic and environmental factors often overlap and are difficult to operationalize, and researchers frequently work with incomplete data.

Family often represents a privileged area of investigation for human survival studies as its members share pieces of their genetic heritage and environment. Its traits significantly affect health status and survival, even at older ages. Relevant characteristics include family size and structure, birth order, the presence or absence of parents at critical periods, living arrangements, wealth, and so on (van Poppel and Liefbroer, 2005). Characteristics of families of origin may persistently affect survival, as events at different life stages – even early ones – impact people's health across lifetimes through an accumulation process or as a long-term consequence of compromising early life damage (Ben-Shlomo and Kuh, 2002).

Studies on the parent-child relationship represent the most consistent body of research, pointing out that the parental effect on offspring survival is complex, and estimates might be affected by the adopted longevity threshold. Cournil *et al.* (2000) for example, reported a positive association between the survival of fathers and that of their offspring, with a marked effect father-daughter at advanced ages. Studies conducted on different population instead reported no statistically significant effect of paternal survival (Mazan and Gagnon, 2007). While, in Sardinia, a more significant maternal effect has been observed (Caselli *et al.*, 2006), pointing for the possible influence from genes and maternally inherited mitochondrial DNA.

This study aims to provide insights into the possible mechanism of familial transmission of survival, trying to estimate the effects of parental loss and parental survival in two significant moments of individual life, namely in early childhood and at older ages, in a bid to answer the following questions:

- In childhood, does the loss of the father affect the survival of offspring? And what is the effect of the loss of the mother?
- In the first five years of life, are the possible adverse effects of the mother's loss mitigated by the presence of other female figures within the family?
- Is there any survival resemblance between parents and offspring? Are long-lived individuals' children of long-lived parents? And at older ages, does the presence of other female figures significantly affect survival?

This work used data derived from the Villagrande Longevity Database (VILD), focusing on all the children (2,173 individuals) born in the municipality of Villagrande Strisaili in Sardinia (Italy) from the 444 marriages celebrated during 1850-1910 for which survival until 2010 is known. Villagrande Strisaili is renowned for the exceptional longevity of its population (Poulain *et al.*, 2004; 2011; Salaris *et al.*, 2013; Salaris, 2015).

The first part of this paper presents a review of studies and related theoretical references on familial transmission of longevity. While the second part describes the data source and quality and the applied methods, followed by the survival analysis results. Finally, the discussion section highlights relevant insights that could contribute to the general debate on the familiar transmission of individual survival, which is genetic but also influenced by social dimension.

2. Materials and methods

2.1. Data sources, data quality, and population under study

Data from the analysis derives from Villagrande Longevity Database (VILD), a three-generation level genealogical database of the municipality of Villagrande Strisaili in Sardinia (Italy), which includes 7,250 individuals, where data was validated to reduce biases deriving from under-registration of births, deaths and migration, age misreporting, and selective censoring (for more details, see Salaris, 2010). The target population of this work initially included 2,306 individuals born from the marriages celebrated from 1850 to 1910, considering only the unions within which there have been births (444 out of 499 marriages). The analysis was restricted to individuals for which survival was known until 2010. Accordingly, 2,173 cases were finally considered for analysis (94.2% of total newborns). Survival resemblance between parents and offspring is investigated, focusing on post-reproduction survival of 50-year-old individuals (1,043 cases). It's worth noting that individuals under study are not interdependent as Ego belonging to birth cohorts from 1850 to 1890 are in large measure included in the analysis as parents of Ego born in the next generation.

2.2. Familial resemblance, longevity threshold and variables

To identify groups of survivors for fathers and mothers of Ego, longevity thresholds were estimated using a Quantile Regression Model (QRM) (Koenker and Bassett, 1978). Table 1 reports the QRM estimates. The median age of Ego is 40.39 for males and 51.16 for females. Gender differences can be attributed to the selective effects of male mortality related to war and accidental death (Salaris, 2015).

Ego age at death, Ego parent age at death, and Ego age at the time of loss of his or her mother or father are all continuous in the extended Cox proportional hazard model, which according to the code assigned to each family, includes family-shared frailty (Therneau and Grambsch, 2000). Models' estimates were controlled for birth

cohort effects as high survival level were observed for individuals born between 1902 and 1911 (Salaris, 2014).

Table 1 – *Age at death of Ego, mothers, and fathers according to specific quantiles*

Quantiles	Age at death of Ego Males	Age at death of Ego Female	Maternal age at death	Paternal Age at death
0.10	0.76	0.95	38.17	48.65
0.20	2.37	2.94	48.15	58.70
0.50	40.39	51.16	71.40	69.91
0.75	78.90	82.08	80.59	80.01
0.80	82.73	84.20	82.13	82.91
0.90	89.76	89.24	87.14	87.70

2.3. Methods

Firstly, infant mortality rates were estimated. Subsequently, the non-parametric approach of Kaplan–Meier (KM) survival estimation (Kleinbaum, 1995) compared selected groups of survivors. Differences within categories were tested for significance using Breslow and Log Rank tests (Blossfeld and Rohwer, 2002). A series of extended Cox proportional hazard models were fit. They included frailty and the birth cohort as control variables. The introduction of shared frailty allows to account for unobserved factors affecting individual risk of mortality, which are assumed to be equally shared with others in the family (Wienke, 2003; Garibotti *et al.*, 2006). Shared frailty is assumed to be gamma-distributed (Therneau and Grambsch, 2000). All covariates met the proportionality assumption, tested using Schoenfeld residuals (Schoenfeld, 1982).

3. Results

3.1. Infancy and mortality. Is survival an early family issue?

Table 2 reports the mortality rates (mx) estimates for all newborns in Villagrande Strisaili (1850-1910). Estimates distinguish between the 'survival category' of parents, namely whether the Ego mother and father belonged to the first 20 percentile of parent survivors ('frail') or the longest-living ones (≥80 percentile, 'robust'). The estimates suggest that the effect of a father's survival on children is limited,

regardless if he is 'frail' or 'robust'. Children of frail mothers have higher mortality rates, which at birth are at 183.0 per thousand (+66%) against an average value of 112.7. These estimates, especially during the first year of life, should be considered with caution as they include cases of maternal mortality and more generally, the available data do not allow to discern among the possible influences of environmental conditions and associated diseases.

Between the first and second birthday, m_x equals 126.9 per thousand (+70%) against an average of 74.4 observed for all infants born in the village. However, this disadvantage attenuates and disappears at subsequent ages. Still, despite some differences, when considering the most robust cluster of mothers, their children prove to be advantaged among their peers.

Table 2 – *Mortality rates (m_x) of all Villagrande Strisaili newborns from birth to age five by parental survival group (value ‰)*

Age	ALL	Std. Er	FRAIL (20%)		ROBUST (20%)	
			Mother	Father	Mother	Father
0	112.7	7.4	183.0	122.6	110.1	116.3
1	74.4	6.3	126.9	63.4	29.9	71.2
2	35.4	4.5	46.2	58.5	33.8	24.0
3	23.5	3.7	23.9	16.0	11.5	24.5
4	18.0	3.3	21.0	29.5	17.5	15.6

Kaplan–Meier (KM) curves help to understand the evolution of mortality trajectories and how the loss of a parent acts on survival estimates at all ages. Figures 1a and 1b clearly show that the loss of one of the parents might be considered a stressful event with a negative impact on individual survival. Effects are more marked from birth to early adulthood but persist at all ages. The mother's loss appears to have a greater impact than that of the father.

And what could be the role played by the presence of other female figures when Ego loses their mother? Figures 2a and 2b compare cumulative survival curves of individuals who had (or not) at least one older sister (aged ten years and over) or one aunt (in the maternal kinship line) when they lost their mothers before their fifth birthdays. Differences between curves in Figure 2b are not statistically significant. In the case of the presence of an aunt, several crossover points occur, which casts doubt about the positive effect of these female figures' presence on Ego's survival. However, the presence of an older sister proves to have a protective effect on Ego survival (Figure 2a).

Figure 1 – *Kaplain-Meier survival curve of Villagrande Strisaili new-borns having or not lost before five years of age*

a) their mother *b) their father*

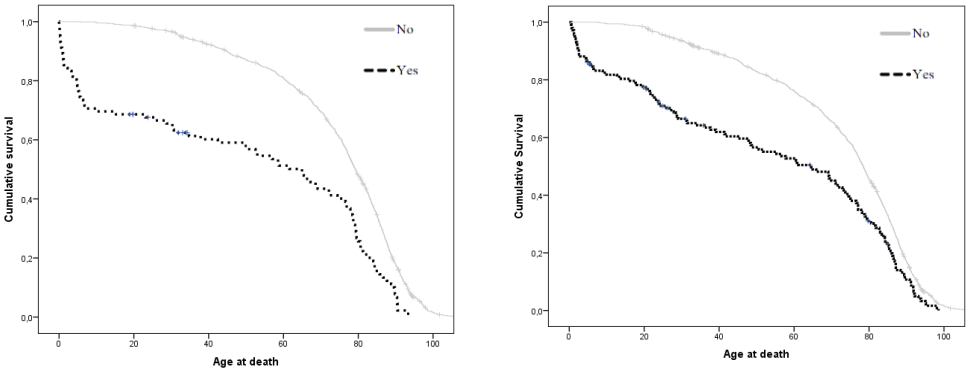
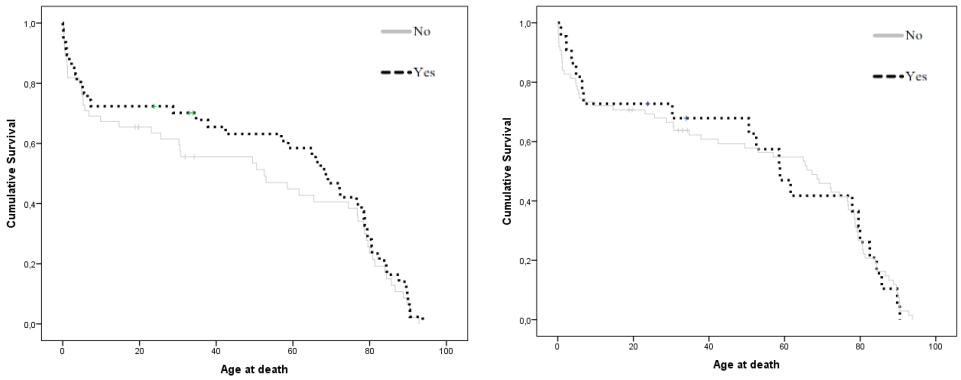


Figure 2 – *Kaplain-Meier survival curve of Villagrande Strisaili new-borns having or not at their mother's death occurring before five years of age*

a) at least one older sister *b) at least one aunt*



3.2. Effect of familial transmission of survival at post-reproduction ages

Focusing now on the possible effects of parental survival on the post-reproductive survival of their offspring, a set of extended Cox proportional hazard models were

fit. Estimates are presented in Table 3. All models have an Ego birth cohort as a control variable, and family-shared frailty frames individuals into their family of origin. Preliminary Model 1 estimates the impact of parental age at death on all newborns included in this study (2,173 cases). Estimates showed no sex effects and maternal and paternal age at death proved insignificant for Ego survival during the entire life span. Only losing the mother before age five proves to have a reducing effect on Ego's probability of survival, meaning that the adverse effects of the mother's death before five years, already detected when analyzing early survival, persist during the Ego lifetime.

Table 3 – *Extended Cox proportional hazard odds ratio of survival for Villagrande Strisaili from birth and age 50+.*

COVARIATES	Model 1 Basic ALL newborns	Model 2 Basic 50+ newborns	Model 3 Adding females figures 50+ newborns
Sex			
Males (ref.)	1	1	1
Females	1.012	1.013	1.070
Age at death of father (continuous)	0.989	1.008	0.990
Age at death of mother (continuous)	1.006	1.000	1.038
Age of Ego at loss of father (continuous)	1.012	1.012	1.040
Age of Ego at loss of mother (continuous)	0.982*	1.008	0.987**
Having at least 1 older sister			
yes			1
no			0.895
Having at least 1 aunt			
yes			1
no			0.914

Legend: *p<0.05; **p<0.01; ***p<0.001

More importantly, the focus shifts to mortality trajectories in post-reproductive ages (1,043 cases). As Model 2 shows, none of the variables included in the model prove to be statistically significant. Separate models were run for males and females, which didn't detect any statistically significant effect of parental death on their

offspring. For the sake of space, the results are not reported here. Although the number of cases is quite limited, Model 3 further explains the possible role of familial characteristics in this environmental dimension. The presence of at least one older sister or aunt when Ego lost their mother before five years of age was introduced into the model. Estimates show that the timing of the mother's loss becomes statistically significant for Ego once the model considers the role of other female family members. This finding cautiously suggests that the presence of an older sister might be viewed as a person of support when a traumatic event, such as the loss of the mother, occurs early in Ego's life.

4. Discussion

This work aimed to investigate the possible effects of the ages at death of parents on their offspring's survival at different stages of their lives, namely early childhood and later life after age 50. Survival trajectories analysis of individuals born in Villagrande Strisaili suggests that between the survival of the parents and that of the offspring, there is an observable link at all ages. However, the maternal bond is the one for which the greatest and, in some cases, statistically significant effects are observed, with no gender effect, confirming prior finding (Salaris, 2010; Salaris *et al.*, 2013).

In the examined community, a traumatic event such as the mother's death before age five for Ego proves to have a relevant impact. This finding makes us think that biological vulnerability, genetic factors, and common pathologies between mother and child lead to higher-than-average mortality rates. Estimates of infant mortality show that the children of frail mothers record higher mortality rates, which at birth are at 183.0 per thousand (+66%) against an average value of 112.7. Deaths between the first and second birthdays are 126.9 per thousand (+70%) versus the average of 74.4 observed for all infants born in the village.

However, higher mortality could also be related to a lack of care when the mother dies. She is the one primarily entrusted with caring for the child. Who takes care of the baby when the mother dies? Support in this direction can be traced in the findings, albeit cautiously, given the reduced number of cases. It derived from analyzing the possible effect on infant mortality estimates of so-called 'alternative' female figures such as one sister older than Ego or at least one aunt (on the maternal line). The presence of one sister in Villagrande Strisaili families - when mother prematurely died - mitigated the adverse effect that such a traumatic event inevitably brought with it.

The parents' survival effect on their children has also been observed in post-reproduction survival in the population studied here. The relationship with the

mother's survival registers the only statistically significant results in the estimates of the Cox proportional hazard models. These findings somehow confirm the indications derived from previous studies and in other populations on the importance of the maternal role for the Ego's survival. However, how could this result be interpreted in the context of Villagrande Strisaili? Providing a genetic explanation can be the most direct choice. But still, in our conclusive reflections, we would like to draw attention to environmental components and the possible role of cultural capital focusing on this select maternal line of transmission. The possible validity of this explanation lies in the fact that most frequent models of cultural transmission are also vertical as genetic ones. Parents transmit to children what they know, from having learned it from their parents, adding what they have discovered, invented, or learned during their existence. Transmission models of knowledge are difficult to distinguish from genetic ones, as they both occur among the same actors and involve a certain resemblance between parents and children or relatives in general (Cavalli Sforza, 2004). Hence, the ability to survive could be part of individual cultural capital, namely the accumulation of knowledge, behaviors, and skills which constitute a resource from which individuals build their cultural competence and social standing. Through contact and interaction, parents transmit their knowledge, allowing their children to learn. Cultural capital exists in an embodied state, namely, the individual identified by the self (Bourdieu, 1986). It is consciously acquired over the life course and passively assimilated through education and socialization of culture and traditions. Offspring survival is time; in our case, the time spent with mothers could also be interpreted as exposure time for acquiring knowledge and valuable skills for survival. The longer the survival of mothers, the longer the available time for children to learn, practice, and assimilate traditions, remedies, and food preparation, which is favorable for their survival. Under this possible interpretation, findings suggest that in Sardinia, the presence of a mother assumes a key role in the survival of the offspring, which might be related not exclusively to genetic endowment. They also transmit to their offspring cultural capital, which is enriched by the role of social networks that are prerogatives of female figures. The relevance of this aspect, in Villagrande Strisaili, can be hypothesized to be accentuated by the cyclical absence of the fathers' transhumant shepherds, which gives mothers a central role in the lives of their offspring. More generally, aware that distinguishing between genetic and environmental effects is not clear-cut, we believe that the latter cannot be discounted as factors of secondary importance. Instead, the observed differential mortality in the Villagrande Strisaili population estimates invites a reflection on the transmission of cultural capital (knowledge and skills) and social networks that would require further investigation.

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LIVING ENVIRONMENT AND LIFE SATISFACTION: SOME INSIGHTS FROM ITALY

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Abstract. With this work, we add to the debate on the significance of the living environment on individual well-being for the Italian case, till now neglected by the literature. Using data from the ISTAT *Aspects of Daily Life* surveys from 2013 to 2021 and considering Italians aged 20 and over, we analyse the relationship between the perceived neighbourhood environment – conceptualized through various dimensions – and individuals' satisfaction with life, also exploring potential heterogeneity by age. Our findings confirm that living environment is an essential predictor for individual well-being, but also reveal that some aspects are important especially at old ages, particularly those about the friendliness, well-maintenance and the ease of access to services in the area.

1. Introduction

The well-functioning and well-being of local communities is a strategic target in government welfare policies, and traditionally research in this domain has focused on the analysis of socio-economic aspects of local areas, such as regional measures of deprivation or social exclusion, or labour market outcomes of residents (for a review see, e.g., Shields *et al.,* 2009). A growing strand of research has also been focusing on the neighbourhood environment as a crucial factor in determining health outcomes, both objectively and subjectively measured (Macintyre and Ellaway, 2003; Diez Roux and Mair, 2010; Weden *et al.*, 2002; Hale *et al.*, 2013). More sparsely, some authors have considered the potential effect of the living environment on measures of individuals' well-being and their quality of life (Shields *et al.*, 2009; Tomaszewski, 2013; Teixeira Vaz *et al.*, 2019).

Our study aligns with this latter line of research, by investigating the relationship between life satisfaction – as a measure of subjective well-being – and some characteristics of the neighbourhood area, as perceived by people who live in that area. The idea is that the perceived neighbourhood environment may be a more telling indicator than objective characteristics (Wen *et al.*, 2006). By making use of nine ISTAT cross-sectional waves of the survey *Aspects of daily life* (2013-2021) and estimating logistic regression models, we add the Italian case to the debate on the significance of living environment on individual well-being, till now neglected by the literature, building on the concept of living

environment from a subjective perspective. We first analyse the effect of the perceived neighbourhood environment on individuals' life satisfaction for the overall population aged 20 and over; second, we explore if and to what extent the diverse facets of the quality of the living area do matter differently by age.

2. The significance of the living environment for health and well-being: Exploring the interconnections

Among the numerous aspects recognised as necessary to enhance individual well-being, like economic comfort, good health, family life and social relationships (e.g., Frey and Stutzer, 2002), a rapidly growing literature refers to the *neighbourhood pathway*, or the importance of the environmental and social characteristics of where people live (Macintyre and Ellaway, 2003).

Much of this literature has considered the health effects of specific socio-economic neighbourhood characteristics – such as economic deprivation, residential mobility, local unemployment or crime rates – or of physical environmental attributes – like air quality, cleanliness and pollution. Individuals residing in deprived neighbourhood areas are particularly vulnerable to increased rates of illness and death (Ellaway *et al.*, 2012). Residing near heavily trafficked roads or in congested traffic areas poses a health hazard and can lead to higher occurrences of respiratory diseases (e.g., Vlahov *et al.*, 2007). Living in a dangerous (i.e. with high criminality rates), polluted and unclean neighbourhood has been found to increase anxiety, anger, and depression levels in residents (Ross and Mirowsky, 2009).

Also, the largely used measure of self-rated health has been found significantly affected by a large set of neighbourhood attributes (e.g., Weden *et al.*, 2008; Wen *et al.*, 2006). In addition, living in deteriorated or unfriendly areas – i.e. characterized by scarce accessibility of public transportation or fresh food markets and grocery, or by lack of green or safe spaces to exercise – may affect lifestyles behaviours (e.g., Heinrich *et al.*, 2007; Salehi *et al.*, 2017), finally deteriorating health outcomes.

In this strand of research, we also locate sparse evidence regarding more nuanced and subjective measures of well-being or life satisfaction. Psychological and personal well-being is directly affected by living in deteriorated neighbourhoods or areas with high crime rates (Tomaszewski, 2013; Taylor and Harrell, 1996): poor living conditions within the local community can considerably diminish one's sense of security, leading to lower life satisfaction. When individuals are surrounded by deteriorating buildings, social problems such as high unemployment and crime rates, and environmental hazards such as noise and pollution, they generally express lower satisfaction with their lives (Teixeira Vaz *et al.*, 2019; Shields *et al.*, 2009). Broadly speaking, environmental sustainability, which includes the availability of public shops,

health and community services and leisure opportunities in a safe neighbourhood (Lowe *et al.*, 2015), has been recognized as essential for fostering place attachment and identity (Hernández *et al.*, 2007), reducing security concerns or social isolation feelings (Lu and Wu, 2022), and definitely enhancing community well-being.

The abovementioned literature refers to both objective and subjective measures when describing the living environment. Nevertheless, some research argued that, although linked, objective neighbourhood context and neighbourhood perceptions are distinct constructs (Wen *et al.*, 2006). Especially, as it happens for subjective measures in general, the perceptions about the living area should not be treated as an indefinite and vague measure of the objective conditions, by entailing an additional meaning that could be relevant to individual well-being. Among the most investigated aspects which provide evidence of the viability of a neighbourhood from a subjective perspective and that have been proven to play a significant role in overall well-being or satisfaction with life, we highlight factors such as access to public transportation, cultural amenities, retail establishments and public offices. Furthermore, sidewalks and pedestrian crossings, access to green spaces, cleanliness and pollution are also significant determinants to consider (Weden *et al.*, 2008; Tomaszewski, 2013; Hale *et al.*, 2013).

To conclude this brief summary of the significance of the environmental quality for health and well-being, it is worthwhile to remember that the various facets of the living environment could be expected to act differently depending on individuals' characteristics, primarily age. For younger residents, for instance, access to cultural, shopping, and sports facilities, and a visually appealing city might represent more relevant factors than for adults or elderly people (Hogan *et al.*, 2016). On the other hand, other features of the immediate neighbourhood are likely to play a role in shaping the well-being of the elderly: health and satisfaction with life of older adults have been found to be strictly associated with the accessibility of key public services in the local area, health facilities, banks or food suppliers (Hogan *et al.*, 2016; Tomaszewski, 2013). In addition, older adults spend much more time in the surrounding neighbourhood, which becomes a source of security and safety (Oswald *et al.*, 2011; Tomaszewski, 2013).

3. Data, variables and method

To investigate the relationship between living environment and life satisfaction, we relied on the latest nine ISTAT waves of *Aspects of Daily Life*, from 2013 to 2021[1], a nationally cross-sectional representative survey which collects rich and detailed demographic, social and economic characteristics of individuals and their families,

[1] We considered the most recent editions of the survey because of consistency of the variables about the area where individuals live.

together with information about their habits and daily life conditions, especially from a subjective perspective. Our analytical sample refer to individuals aged 20 and over at survey time and included 276,304 individuals.

Our outcome variable was life satisfaction, a comprehensive measure of individual's overall well-being (Diener *et al.*, 2002), also found to be correlated with morbidity, depression, and overall health status throughout life (e.g., Collins *et al.*, 2009). In our data, life satisfaction was measured through the question "Currently, how much are you satisfied about your life overall?". The possible responses were ordinal in nature and ranged on a numerical scale from 0 to 10, where 0 corresponded to *not at all satisfied* and 10 to *very satisfied*. The response distribution was skewed towards higher levels of satisfaction, with a third of the sample rating it 6 or lower, and about one out of four 7 and 8 respectively. To disentangle highly satisfied and not satisfied respondents, we dichotomised the variable, opposing those who rated their life satisfaction from 8 to 10 – highly satisfied individuals, namely 41% of the sample, *vs* those who provided an assessment from 0 to 7 – that is people not (entirely) satisfied (59% of the sample[2]).

Our main focus in explaining life satisfaction was living environment, which we operationalised through various ad hoc indicators, built expressly considering individuals' evaluations of different aspects of their residential area. Based on previous literature (e.g., Ross and Mirowsky, 1999; Weden *et al.*, 2008), and also supported by an explorative factor analysis, we relied on two major domains representing the quality of the living environment from a subjective perspective: *liveability* and *accessibility*. For the first one, the liveability, we built three normalised[3] indicators highlighting three distinct and well-defined dimensions[4]: (1) *security*, including only one item about the perceived criminality risk in the surrounding area; (2) *friendliness* of the area, composed by four items about (i) parking difficulty, (ii) traffic, (iii) air pollution and (iv) noise of the surrounding area; (3) *maintenance*, formed by three items about the presence of (i) dirt and garbage, (ii) inadequate lighting in the streets, and (iii) bad condition of the pavement. For the second domain, accessibility of daily services, it resulted characterised by two main dimensions, for which we again built two normalised indicators[5]: (1) *services access*, which considered access to (i) postal office, (ii) municipality offices, (iii) police station, (iv) pharmacy, (v) emergency room; (2) *goods supply*, indicating accessibility of (i) markets and (ii) supermarkets.

[2] We re-run our models trying alternative formulations, such as continuous specification, or dichotomizing 0-6 vs 7-10. Results remained virtually unchanged.

[3] We relied on a modified version of the min-max procedure, where the minimum value is 1 and the maximum is 3.

[4] For each item, the respondents were asked to indicate to what extent "The area where the family live presents…", with responses possible on a 4-level scale, where 1 meant *a lot*, 2 *quite a lot*, 3 *a few* and 4 *not at all*. To interpret the indicators in positive terms – or liveability – the normalized indicators have been finally reversed.

[5] For each item, the respondents had to answer to the question "Generally, does joining the following services entail problems of difficulty for the family?", according to a 3-level scale where 1 corresponded to *a lot of difficulty*, 2 to *some difficulty*, and 3 to *no difficulty*.

The resulting five normalised indicators ranged from 1 to 3, where 1 means a *low* level of liveability/accessibility, 2 a *medium* level and 3 a *high* level (see Table 1).

Table 1 – *Sample distribution of the covariates used in model estimation, by life satisfaction. Column percentages.*

	highly satisf.	not satisf.	Total		highly satisf.	not satisf.	Total
Security				Living arrangement			
low	30.7	23.9	27.9	alone	13.3	17.0	15.5
medium	43.8	42.9	43.5	couple with child.	50.4	44.5	46.9
high	25.4	33.2	28.6	couple w/o child.	24.8	21.9	23.1
Friendliness				single parent	7.7	11.4	9.9
low	12.7	9.8	11.5	other family types	3.9	5.2	4.7
medium	50.2	44.6	47.9	Education			
high	37.1	45.6	40.6	high	58.8	50.8	54.1
Maintenance				medium	25.9	28.6	27.5
low	12.4	9.3	11.2	low	15.4	20.6	18.5
medium	60.5	54.6	58.1	Economic resources			
high	27.1	36.0	30.8	good	74.0	53.6	62.0
Services access				not good	26.0	46.4	38.0
low	6.2	3.7	5.2	Self-rated health			
medium	27.2	20.6	24.5	good	56.7	73.8	63.8
high	66.6	75.7	70.4	not good	43.3	26.2	36.2
Goods supply				Area of residence			
low	5.8	4.1	5.1	North-West	23.8	20.5	21.9
medium	27.3	23.1	25.6	North-East	25.0	18.1	20.9
high	66.8	72.8	69.3	Centre	18.0	18.9	18.6
Sex				South	24.3	32.3	29.0
men	49.2	47.0	47.9	Islands	8.8	10.2	9.6
women	50.8	53.0	52.1	City type			
Age class				metropolitan area	18.5	23.5	21.5
20-34	18.6	17.5	18.0	>10000 inhabitants	42.7	44.3	43.6
35-49	27.8	25.3	26.3	<10000 inhabitants	38.8	32.2	34.9
50-64	27.0	27.6	27.4				
65-74	14.7	14.4	14.6				
75+	12.0	15.1	13.8				

Source: Authors' elaborations on Aspects of Daily Life surveys, 2013-2021.

To control for potential heterogeneity in the relationship between life satisfaction and living environment, we considered in our analysis a large set of demographic and socio-economic confounders[6]: sex (male; female); age (divided into classes: 20-34; 35-49; 50-

[6] We also considered the migrant status, since the living arrangements (and the perception of it) can be very different between migrants and natives. The results were virtually unchanged, and because the migrant status has been

64; 65-74; ≥75); living arrangement (alone; in couple with children; in couple without children; single parent; other family types); education (low; medium; high); perception of the economic resources (not good; good); perception of health (not good; good). To account for territorial variation, also potentially linked to the liveability and accessibility indicators, we considered the area of residence (North-West, North-East, Centre, South, Islands) and the city type (metropolitan area, <10.000 inhabitants, ≥10.000 inhabitants). The survey year – from 2013 to 2021 – was also included in the model specification. Table 1 shows the sample distribution of the various dimensions of liveability and accessibility and the control covariates, differentiating between highly satisfied and not completely satisfied individuals.

To assess the association between the various dimensions of liveability and accessibility – namely security, friendliness, maintenance, services access and goods supply – and life satisfaction, controlling for the confounders listed above, we estimated a logistic regression model. In addition, to explore whether the different dimensions of the living environment differently affect individuals depending on their age, we estimated a further set of logistic regression models by adding an interaction between the age classes and the five indicators of liveability and accessibility (each interaction has been modelled separately to avoid over-specification). In the following section we present our results in terms of Average Marginal Effects (AME).

4. Results

4.1. Living environment and life satisfaction

Table 2 reports the results from the logistic regression model on the probability of being highly satisfied *vs* being not (entirely) satisfied, in terms of AMEs.

It is straightforward that, all other things being equal, living in a good and well-mannered environment and with easy access to services is positively correlated with life satisfaction. The most notable neighbourhood features linked to life satisfaction are *security*, *friendliness* of the area (in terms of absence of traffic, air and noise pollution in our specification), and *services accessibility*. The average marginal effect of perceiving high quality as for these aspects on the probability to be highly satisfied ranges from 3.6 to 3.8 percentage points (p.p. hereafter) relative to the medium level.

included in AVQ survey only since 2015, we decided to exclude this aspect from the analysis to preserve the sample size.

Table 2 – *Probability of being highly satisfied vs being not (entirely) satisfied, models' results: AME (in p.p.) for the covariates introduced in the model.*

	AME (p.p.)	Std. Err.	P>z
Security (ref. medium)			
low	-1.3	0.279	*0.000*
high	3.8	0.291	*0.000*
Friendliness (ref. medium)			
low	-0.3	0.376	*0.411*
high	3.7	0.265	*0.000*
Maintenance (ref. medium)			
low	0.5	0.384	*0.181*
high	2.8	0.269	*0.000*
Services access (ref. medium)			
low	-1.2	0.619	*0.056*
high	3.6	0.298	*0.000*
Goods supply (ref. medium)			
low	0.8	0.619	*0.179*
high	2.6	0.289	*0.000*
Sex (ref. men)			
women	-0.4	0.153	*0.011*
Age classes (ref. 20-34)			
35-49	0.7	0.292	*0.020*
50-64	-1.4	0.284	*0.000*
65-74	0.7	0.386	*0.070*
75+	-0.4	0.441	0.346
Living arrangement (ref. couple with children)			
alone	-6.5	0.302	*0.000*
couple w/o children	0.9	0.315	*0.005*
single parent	-9.6	0.371	*0.000*
other family types	-6.3	0.599	*0.000*
Education (ref. low)			
medium	1.1	0.334	*0.001*
high	4.1	0.340	*0.000*
Economic resources (ref. not good)			
good	16.3	0.236	*0.000*
Self-rated health (ref. not good)			
good	15.8	0.217	*0.000*
Area of residence (ref. North-West)			
North-east	1.3	0.340	*0.000*
Centre	-3.4	0.352	*0.000*
South	-8.4	0.322	*0.000*
Island	-4.1	0.436	*0.000*
City type (ref. metropolitan area)			
<10000 inhabitants	6.1	0.332	*0.000*
>10000 inhabitants	3.7	0.301	*0.000*
Survey year (cnt.)	1.0	0.043	*0.000*

Source: Authors' elaborations on Aspects of Daily Life surveys, 2013-2021.

As for security and services accessibility (in this latter case with a significance at 10% level), we find a positive gradient – that is living in low quality areas decreases life satisfaction – whereas for friendliness, low and medium levels are not statistically different.

Then, we find that a high level of market accessibility (i.e., *goods supply*) and *maintenance* are essential in enhancing life satisfaction, although with a somewhat lower, but still important, magnitude (AMEs equal to 2.6 and 2.8 p.p. respectively, relative to the medium level).

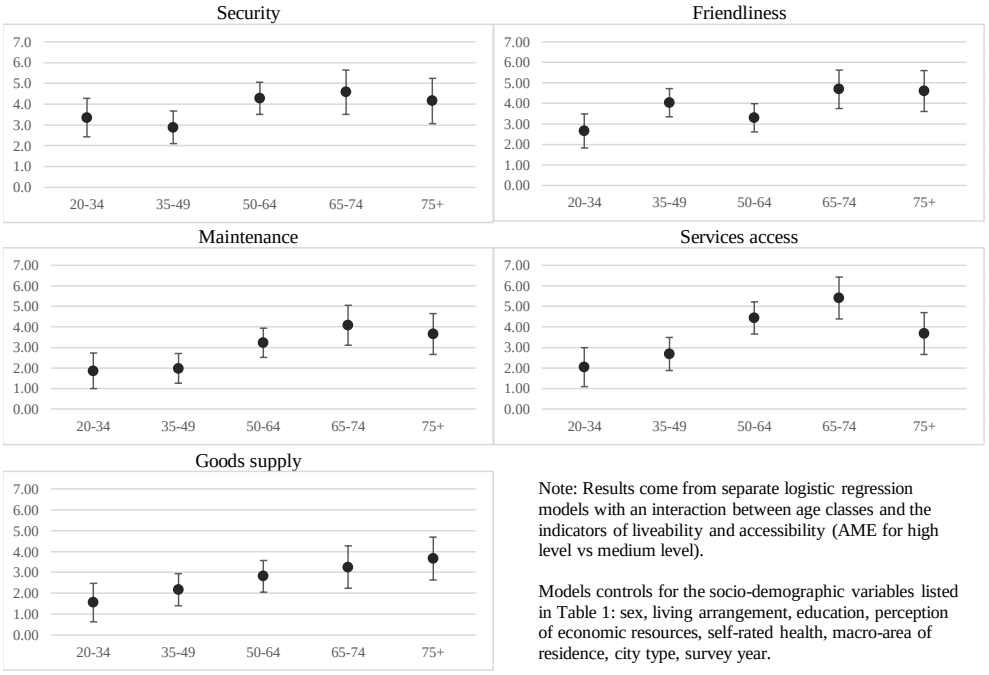
Estimates for the socio-demographic confounders confirm previous findings on other contexts: women are less satisfied than men, and satisfaction tends to decrease with age. Life satisfaction tends to be higher for people living in couples (both with or without children), while it decreases for those living alone, single parents or other family types, other things being equal. A positive association with life satisfaction is also found for educational levels and, with a high magnitude, economic resources (AME = 16.3 p.p.) and self-rated health (AME = 15.8 p.p.).

In addition to these measures of liveability and accessibility, the macro-area of residence and the city type also play an autonomous role. Specifically, Italians living in Southern regions are less likely to be satisfied (AME = -8.4 p.p.) than those in the North-West. A lower probability is also found for the central regions and the Islands. Somewhat expected, people living in metropolitan areas are generally less likely to be satisfied with their lives, followed by those residing in bigger centres residents (≥10,000 inhabitants, AME = 3.7 p.p.); instead, those residing in small municipalities have the highest level of satisfaction (<10,000 inhabitants, AME = 6.1 p.p.). Finally, it seems that life satisfaction perception positively increased in the last decade.

4.2 Age differentials in the relationship between living environment and life satisfaction

After having assessed the existence of a positive relationship between the various dimensions of the living environment and life satisfaction, our aim was to explore potential age differences in this relationship. According to the previous literature (e.g., Hogan *et al.*, 2016; Tomaszewski, 2013), the numerous facets of liveability and accessibility may differently concern and distress individuals depending on their age, due to their different characteristics, needs, and requirements. In Figure 1, for each liveability/accessibility indicator, we show the average marginal effects on the probability to be highly satisfied, by age class. Because we found that the low and medium categories of the indicators are not substantially different (except for security and, at 10% level for services access), we reported here only the estimated AME of the high level of the indicator versus the medium one.

Figure 1 – *Probability of being highly satisfied vs being not (entirely) satisfied, models' results: AME (in p.p. with confidence interval at 90% level) for the five indicators of liveability and accessibility (high level vs. medium level) by age class.*



Source: Authors' elaborations on Aspects of Daily Life surveys, 2013-2021.

When *security* is considered, we don't find significant age differentials, which means that secure areas represent key aspects for satisfaction with life at all ages. Otherwise, *friendliness* and *maintenance* of the area seem especially important for the well-being of elderly than for that of young adults (significant at 10% level). Whereas the probability of being satisfied with life increase of 4.6-4.7 p.p. for an old person living in a friendly area, for a young adult the effect is reduced (AME ranging from 2.6 to 4.0 p.p. depending on age). Similarly, for maintenance the marginal effects range from 1.9 p.p. for the youngest to 3.7-4.0 for the elderly.

As for the accessibility domain, a high level of *services access* is importantly related to individual life satisfaction especially for people aged 50-74 (AME from 4.4 to 5.4 p.p.) and to a lower extent also for people aged 75 and over (AME = 3.7 p.p.) relative to young adults (AME from 2.0 to 2.7 p.p.). Results for accessibility to *goods supply* show an increasing importance of this aspect for life satisfaction as far

as age increases, especially for the oldest group (AME=3.7, significantly different at 10% level relative to the youngest age group).

5. Conclusions

In this work, we provide fresh evidence, completely new for the Italian context, on the importance of *external effects* on life satisfaction (Shields *et al.*, 2002), focusing on the quality of the area where individuals live from a multifaceted subjective perspective. Liveability and accessibility of the living area have been proved noteworthy to enhance the well-being of the entire population. Confirming results for other contexts, living in a good and well-mannered environment, with ease of access to services, is positively correlated with life satisfaction at all ages. Additionally, age has emerged as an important characteristic in shaping the contribution of neighbourhood conditions. We found that aspects linked to the accessibility of the area, e.g., the ease to access public offices, pharmacies and health services or goods suppliers, as well as living in a friendly (i.e., unpolluted, quiet and not trafficked) and well-maintained (i.e., clean, with adequate street conditions and lighting) area are especially important for older people, who may experience mobility difficulties in this phase of life.

Overall, our findings highlight the importance of creating and maintaining supportive living environments that promote well-being for individuals and communities. By considering various facets and perspectives of environmental quality, the study may also be of interest to policymakers and urban planners: gaining insights into dimensions that hold meaning for residents and where their needs remain unaddressed might furnish community developers with valuable information.

We acknowledge that this study does not fully capture the complexity of living and neighbourhood environment. In addition, as we rely on perceptions, it is necessary to recognize that individual assessment can also be influenced by other individual or contextual attributes that we are not able to account for in the analysis. Nevertheless, the use of subjective measures both for the outcome and the key explanatory variables is an explicit choice, following the idea that individual perceptions are expected to predict more of the variance in well-being (e.g., Ettema and Shekkerman, 2016) and could be able to carry an additional significance on neighbourhood characteristics (e.g., Zhang *et al.*, 2022).

Bearing in mind these cautions, this work does suggest some directions for further research in this domain. For instance, we deem that a deeper investigation and understanding is needed as for other outcomes (e.g., self-rated health), other aspects of daily life and living areas (e.g., housing conditions or the social characteristics of the area), and specific population groups (e.g., elderly or more fragile individuals).

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ITALY IS AGEING, WHO WILL TAKE CARE OF IT?[1]

Arianna Carra, Paola Maddalena Chiodini, Paolo Maranzano

Abstract. Italians are getting older and demand more and more attention on medical care. However, the need to curb public spending calls for a radical reorganisation of the Italian healthcare system. A study of the data available from the Istat - HFA (Health For All) data set reveals a general picture where it seems that supply is struggling to meet demand, pushing families towards a system of private care. A spatio-temporal regression model is presented to interpret the phenomenon and better understand the dynamics of the last two decades and better chart the future of our healthcare system. The resulting picture is that of a nation with different care needs per geographical area. The alpine areas and *Rome Capital* are the most important.

1. Dynamics and Structure in the evolutionary arc of the resident population of Italy

Demographic ageing seems to have become a significant topic of discussion in different areas. The phenomenon, which demographers have already noticed over the past decades, has long remained secluded in the classrooms of scholars and researchers. Only recently, when it has become an irreversible process, the subject of population ageing has begun to be the object of lively discussions. The situation has now reached a considerable weight in several spheres of interest, among all: social and family policies, pension, health, employment, savings, and consumption up to the environmental sphere (see, for example, Reynaud and Miccoli, 2016; Crescimanno *et al.*, 2009). The ageing of the population does not only concern Italy (European Commission, 2021) but in our country, it is also accompanied by the general demographic decline that has been underway for some years now. In fact, in the long path that we can follow starting from 1952, the amount of Italy's resident population has almost always grown year by year: we can appreciate an increase from over 47.5 million units at the beginning of the period to 60 million units at the beginning of 2014, after having passed the twenty years of 'stagnation' at the end of

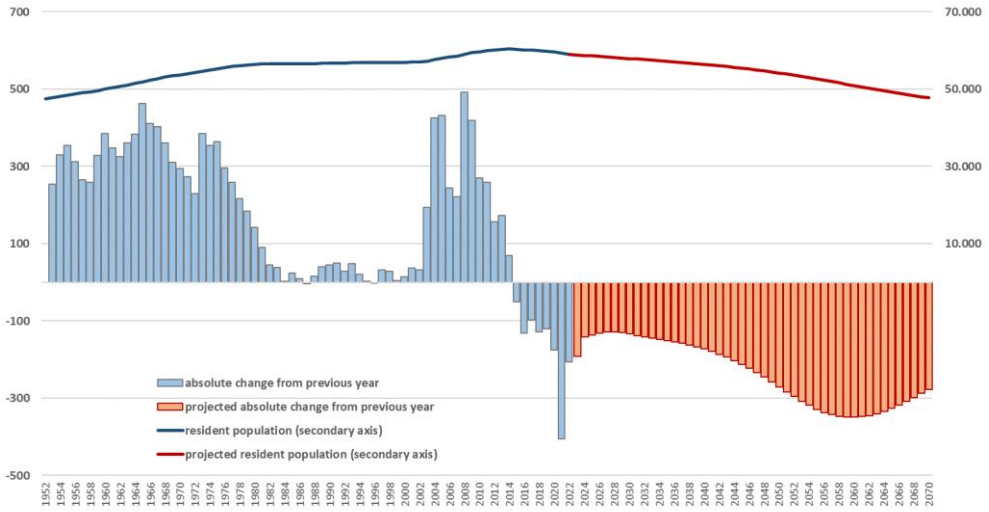
[1] The work is the joint responsibility of the authors. Paragraph 1 is attributed to Arianna Carra, paragraph 2 to Paola Maddalena Chiodini, paragraphs 3 and 4 to Paolo Maranzano, paragraph 5 is made by common effort of all the authors.

the 20th century. Subsequently, negative annual variations have occurred, which, within eight years, led to an overall decrease - accentuated in 2020 by the pandemic - of about 1.316 million units. If the hypotheses used for the construction of the 'median' forecast scenario by ISTAT (Istat, 2022) were actually verified, between 2023 and 2070, a further 11 million individuals would be lost, and the population would return to the levels of the 1950s (see Figure1).

Beyond the demographic decline that has begun, the profound structural change that has characterised the resident population needs to be focused on.

This is an epochal change: pandemics aside, progress in the fight against mortality has enabled ever larger contingents to reach old age, and at the same time, persistently low fertility levels have, in quantitative terms, reduced the younger part of the population.

Figure 1 – *Resident population on 1 January and changes from the previous year - Italy - 1952-2070 - absolute values (thousands).*



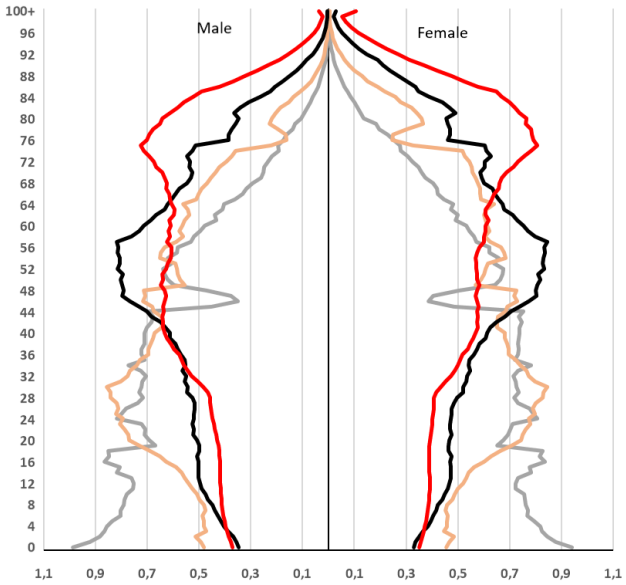
ISTAT data elaboration.

This phenomenon is also observable by the pyramid profiles by gender and age for some 'sample' years[2]. In 2022, almost a quarter of the population (23.8%) is at

[2] From the analysis of the consolidated data, 1965 appears to be as the year with the highest percentage of the population aged 0 (1.9%) and, moving 30 years forward, the effect of the continuing decline in fertility can be appreciated. The year 2022 shows the current state while, according to the data of the 'median scenario' of the demographic forecasts, the maximum values for the percentage of the population aged 65 and over and for the

least 65 years old; of this segment, 32.1% is already 80. In 2050, according to the 'median scenario' forecast, the percentage of over-65s would rise to 34.9 per cent, and the demographic old-age dependency ratio would indicate the presence of 65.3 individuals aged 65 or over potentially 'dependent' for every 100 persons considered to be of working age. From the Baby boom years, we have moved on to the beginning of the *Elderly boom* era, symbolically represented here by the age pyramid to 2050 (see Figure 2).

Figure 2 – *Age pyramids of the resident population as of 1 January 1965, 1995, 2022 and forecasts to 2050 - Italy - (percentage values).*



ISTAT data elaboration.

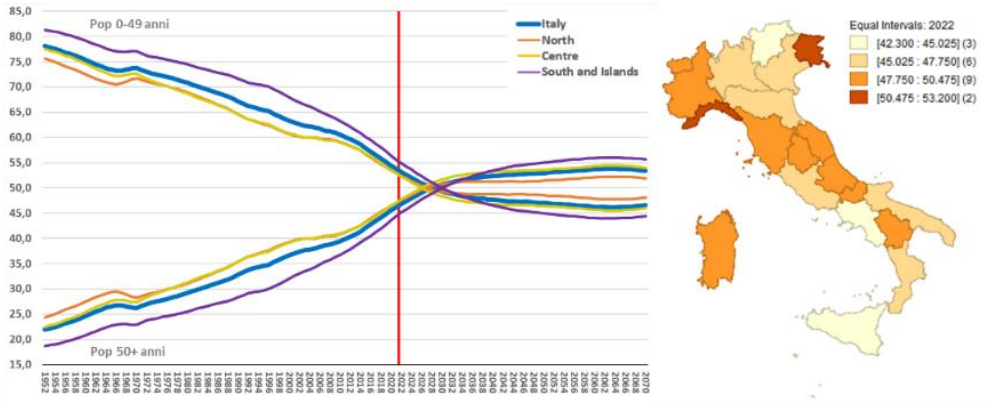
Even if fertility were to rise again in the future, given the current contingents of women of childbearing age (15 to 49), the number of births would still suffer. At the same time, until the 'heritage' of the past is exhausted, the *Baby boom* generations will continue on their way, first ageing and eventually dying out. Figure 3 compares, year by year, the percentages of individuals in the age groups up to 49 and from 50 onwards[3] and shows how the two aggregates are not only converging but also how,

demographic old-age dependency ratio, which is calculated by relating the population units aged 65 and over to the number of individuals aged between 15 and 64, would be reached during 2050: ID A= $\frac{P_{65+}}{P_{15-64}} \cdot 100$.

[3] Considering that 49 is the upper limit of childbearing age for women, the comparison is made, on a quantitative level, between individuals belonging to the first 50 generations and those belonging to the following ones, which,

in the future, the 'more mature' part will be numerically preponderant. Moreover, in some regions[4], the situation described is already a reality in 2022. These considerations give rise to the realisation that, in the absence of upheavals in migration or, in any case, of 'extreme' and external events and/or policies capable of affecting the structure and size of populations, the trend towards ageing and decline will continue in the years to come.

Figure 3 – *Population aged 0-49 and 50+ by Italy and Breakdowns (1952 to 2070) and proportion of individuals aged 50 and over in the regions (year 2022) - percentage values.*



ISTAT data elaboration.

2. Greater longevity comes at a price

'Italians are getting older and heading for extinction'. This is the hammering message one hears repeated by the media. The number of children is decreasing, and there is no adequate generational turnover. On the other hand, life has become much longer, and we have also learnt to take care of ourselves to the point that the new slogan is that at 60 or 70 people are still active and fit. So, when does old age begin? When can a person be called an elder? Maybe after the 70s? The third age no longer begins with the famous threshold of 65 years (more or less coinciding with retirement age) but at least a decade later.

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although they include centenarians and the over-centenarians, can be considered the other 'half' of the range of human life variation.

[4] As of 1 January 2022, the proportion of over-50s is above 50 per cent in Liguria (53.2 per cent), Friuli-Venezia Giulia (50.6 per cent) and Sardinia (50.2 per cent) and is close to numerical parity with the under-49s in Piedmont (49.7 per cent), Molise (49.6 per cent), Umbria and Tuscany (49.4 per cent in both).

All these factors, which certainly make us happy, have, on the other hand, a considerable impact on the socio-economic fabric and especially on the health front. Keeping healthy entails a particular effort not only on the part of the individual, who must follow a healthy lifestyle but also on the healthcare system that must take on the care that the ageing individual needs with increasing intensity: greater longevity entails more visits and medical treatment and also greater consumption of drugs.

Is our healthcare system ready to support this growing demand for care? In a nutshell, is the demand (for care on the part of Italians) fully met by the public healthcare supply or must private supply also be used?

An analysis of the data offered by the Health For All-HFA5 database (source: Istat) immediately reveals certain behaviours. The analysis is conducted on a time series covering the last twenty-five years or so (1995-2019) net of the pandemic period. The Covid pandemic period was deliberately excluded as it represents a break in the time series with totally different dynamics linked to particular and unique factors that are not the subject of this work.

The picture that is defined is very clear. As early as 2000, a gradual growth in the number of older people (population over 80) began to be appreciated. The trend is the same in all Italian regions. Against this trend, on the other hand, is the contraction of the share of public health expenditure in total public expenditure to the same extent in every region. Similarly, the downsizing and reorganisation of public expenditure in the healthcare sector have led to a contraction in the number of beds in public hospitals in geriatric wards, although in different ways in various regions. If for the majority of the regions, the variation in the period considered seems to be contained (no more than 6 percentage points), the same cannot be said for Valle d'Aosta region where a negative variation of about 20 percentage points is recorded, followed by Veneto (-15 points), Abruzzo (-11 points), Trentino Alto Adige (-10.5 points) and Emilia Romagna (-9 points). (see Table 1).

All this suggests that the State's effort is in the direction to reorganise and rationalise the resources invested, so much so that the aim is not to offer more beds for elderly patients but rather to push in the direction of caring for the elders at home or at another type of facility that avoids hospitalisation. This is the new trend being observed concerning all age groups, i.e. hospitalisation is only aimed at severe cases that cannot be managed at home or on an outpatient basis. It is a standard view that care at one's own home can facilitate full recovery in a shorter time by finding the patient in a more hospitable family environment and also avoiding a sense of abandonment, especially in the case of elder patients (Banchero and Trabucchi, 2010, Di Rosa, Melchiorre and Lamura, 2010, Guaita and Casanova, 2010,

[5] Instructions for downloading the database Health For All-HFA are available at the following link: https://www.istat.it/it/archivio/14562

Melchiorre et al, 2010., Pesaresi, 2010, De Compadri et al, 2012, Fosti, 2012, Granata, 2012, Noto, 2012, Rice, 2012).

Table 1 – *Rate of hospital beds in geriatrics*.

Regione	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Piemonte	3.09	3.34	3.1	2.8	2.55	2.43	3.02	2.39	2.31	2.29	2.19	2.47	2.43	2.66	2.59	2.32	2.29	2.23	1.98	1.96	2	1.9	1.88	1.91
Valle d'Aosta	26.8	26.3	25.3	24.4	23.1	23.7	22	22.8	18.6	17	21.4	17.1	16.5	16.2	17.2	17.5	17.2	14.3	5.25	6.56	6.15	6.09	6.04	6.31
Lombardia	4.01	3.41	3.07	2.45	2.4	2.26	2.2	2.09	1.86	2.01	2.09	1.99	1.98	1.96	1.63	1.6	1.55	1.36	1.27	1.29	1.2	1.15	1.07	1.11
Trentino-Alto Adige	23.8	23.1	17.5	16.4	16.9	15.6	14.8	15.2	15	14.7	15.3	15.7	13.5	13.1	13	11.9	11.4	11.1	10.2	10	9.87	9.26	8.98	8.23
Veneto	24.6	22.8	21.3	19	17.2	15.5	14.4	13.2	12.6	12.1	12.3	12.1	10.6	10.4	10.7	10.8	10.4	9.76	10.1	9.57	8.91	8.63	8.78	8.51
Friuli-Venezia Giulia	1.98	1.96	1.95	1.94	1.56	1.19	1.17	1.19	1.17	1.37	0.95	0.93	0.85	0.84	0.83	0.83	0.81	0.63	0.62	0.65	0.8	0.8	0.79	0.78
Liguria	3.35	2.59	2.19	1.64	1.66	1.65	1.6	1.07	1.07	1.41	1.38	1.28	1.27	1.27	1.23	0.72	1.56	1.42	1.97	1.67	1.67	1.67	1.72	1.92
Emilia-Romagna	15.6	15	11.6	9.49	8.94	7.99	7.35	7.1	6.79	6.82	6.37	6.08	6.21	6.23	6.05	6.2	5.97	5.39	5.02	5.05	4.93	4.95	4.69	4.78
Toscana	2.94	2.31	2.12	2.03	2.7	2.65	2.51	2.16	1.92	1.81	1.75	1.64	1.47	1.17	1.48	1.13	1.27	1.14	1.22	1.3	1.77	1.82	1.7	1.59
Umbria	0.92	0.9	0.89	0.88	0.86	1.5	1.47	1.34	1.67	1.64	1.58	2.05	2.33	1.88	1.77	1.77	1.76	1.78	2.11	2.18	2.12	2.15	2.18	2.18
Marche	6.61	6.47	5.62	5.21	5	4.33	3.95	2.78	3.44	3.27	3.29	3.25	3.08	3	2.99	3.58	3.3	3.36	3.14	3	3.03	2.7	2.28	2.92
Lazio	5.98	5.05	5.39	3.89	3.39	3.38	2.75	2.25	2.32	3.03	2.79	3.19	2.88	2.29	2.28	2.14	2.15	1.91	1.88	1.92	1.99	2.27	2.04	1.91
Abruzzo	15.3	9.27	9.56	9.73	10.5	10.3	10.9	10	8.26	10.1	10.5	10.3	7.82	7.15	7.48	6.85	6.55	6.55	5.86	5.65	5.36	5.28	5.37	4.32
Molise	0	0	0	0	0	2.96	2.79	2.61	4.02	3.99	3.97	3.83	3.7	2.28	2.28	2.29	2.28	2.24	2.2	2.18	2.16	1.48	0.93	0
Campania	6	3.91	3.91	3.46	3.11	3.15	2.9	2.57	2.57	2.62	2.45	2.65	2.56	2.39	2.18	1.62	1.38	1.28	1.25	1.21	1.25	1.2	1.2	1.11
Puglia	12	12.3	11.7	10.2	9.33	9.08	8.08	7.89	7.6	6.98	6.74	6.42	6.03	6.12	5.83	4.93	4.81	3.89	3.54	3.79	4.47	4.02	4.19	4.02
Basilicata	9.63	7.93	7.17	6.71	6.56	6.44	6.32	6.21	6.12	6.04	5.41	4.64	4.64	5.48	5.49	5.49	4.53	4.45	4.37	4.31	4.75	5.95	4.66	4.64
Calabria	7.39	7.45	7.02	5.79	6.67	6.39	6.26	5.74	5.34	4.26	4.65	4.4	3.91	4.24	3.53	3.75	3.27	3.22	2.32	2.39	2.48	2.71	2.83	2.93
Sicilia	4.74	4.62	4.47	3.22	3.35	3.27	3.1	3.32	3.05	3.05	2.95	3.17	3.09	2.91	2.79	2.72	2.44	2.44	2.26	2.36	1.92	1.8	1.71	1.74
Sardegna	16.3	13.5	13.3	10.4	9.89	10.2	9.98	9.39	9.26	7.14	8.07	6.45	6.21	6.14	5.86	5.24	4.97	4.77	4.48	4.52	4.56	4.44	5.65	4.92

*Table notes: Hospital beds in geriatrics per 10,000 inhabitants aged 65 and over - HBgeriatrics/Pop65+*10.000 – HFA data. (Indicator code 7240)*

If, on the one hand, this postponement to the family unit makes it possible to ease the pressure on the national health system, on the other hand, it entails a managerial and economic burden for families, who have to deal with the problem of finding specialised health personnel to provide services at home (ADI Integrated Home Assistance, whether offered by the public health service or by private organisations) and all the non-specialised figures who can help manage the older person, mainly if not wholly self-sufficient (i.e. carers).

Table 2 – *Percentage specialist examinations (excluding dental) against the payment 65-74 -Male and Female*.

Macro area	2017	2018	2019	2020	2021
Italia	33.87	34.67	35.36	37.28	41.93
Nord	32.97	34.44	35.18	36.54	41.31
Centro	42.02	40.44	38.82	43.82	49.05
Mezzogiorno	29.93	30.65	33.19	33.92	37.6

Table notes: – Percentage of specialist visits with full payment or with full or partial reimbursement of insurance by age x per 100 specialist visits by age x HFA data. (Indicator code 7477).

Therefore, it appears that the central government's effort to sustain a growth trend in current per capita public health expenditure is insufficient to cover the growing demand for healthcare (Boscolo *et al*, 2022. Fenech, 2022., Giudice, 2022).

Table 3 – *Percentage specialist examinations (excluding dental) against payment over 75 - Male and Female.*

Macro area	2017	2018	2019	2020	2021
Italia	32.39	32.87	32.87	34.3	39.52
Nord	31.67	33.21	32.02	34.24	39.4
Centro	36.87	37.38	36.12	37.82	43.7
Mezzogiorno	30.48	28.73	31.89	31.66	36.47

Table notes: – Percentage of specialist visits with full payment or with full or partial reimbursement of insurance by age x per 100 specialist visits by age x HFA data. (Indicator code 7478).

This is confirmed, for example, by the progressive increase in the average number of patients per general practitioner, the considerable increase in the rate of drug consumption, a phenomenon that shows less and less variability between the different regions as the age of the population increases, and a significant increase in per capita health expenditure, again by households. So how are citizens, and especially senior citizens, treated in Italy? It seems evident that where the resources made available by the State are insufficient, the family resorts to private facilities and makes up for the failure of the public service by investing its own financial resources. This can be seen from the data provided by ISTAT (HFA dataset), which highlights how in the years following 2017, an increasing value of the percentage of specialist visits against payment can be appreciated (see Table 2 and Table 3).

3. Data analysis: a spatio-temporal approach

We propose an empirical analysis in which the household health expenditure is related to various demographic, socio-economic and health factors. The objective is to identify the relevant determinants that explain the temporal evolution of household expenditure across the Italian regions. In particular, we are interested in:

i. Understanding the role of public intervention in sustaining the overall expenditure of the families and reducing its burden;
ii. To check for geographical differences in household health expenditure after considering the national dynamics common to all regions.

We considered the following set of yearly variables[6] observed from 1998 to 2019 at the regional level:

[6] ▪ households expenditure for health (Indicator code 9032)
▪ share of public expenditure in healthcare (% of total expenditure) (Indicator code 9020)
▪ share of public hospital beds for elderly people (% of total hospital beds for older people) (Indicator code 7241)

- share of public expenditure in healthcare (% of total expenditure);
- share of public hospital beds for elderly people (% of total hospital beds for older people);
- share of people over 80 years old (% of the total population);
- the average amount of patience per doctor;
- rate of integrated home care assistance for people over 65 years old;
- rate of drug consumption for the whole population.

The household expenditure is investigated using a regression model belonging to the family of Generalized Additive Models or GAMs (Wood, 2017). The regression model is built in such a way as to address both the spatial and temporal evolution of the expenditure through a so-called spatio-temporal GAM. In addition, we take into account the positive skewness characterising the distribution of the data by using a Gamma distribution with a logarithmic link function for the response variable. The spatial trend is introduced in the model using a polynomial specification given by the linear combination of latitude and longitude of the regions' centroids, while the temporal trend is included by a smooth function evolving through the years. The main advantage of using GAMs is the ability to flexibly shape the relationship between the response and the covariates through smooth functions that represent the predictors as the summation of a basis expansion (Ramsay, 2005), typically splines. This is particularly relevant when modelling spatio-temporal tendencies. For example, in the case of spatial or temporal trends, the data are unlikely to show strongly linear trends but will instead be subject to smooth but non-linear patterns. In our application, intending to avoid imposing restrictions on the functional form of the model, we include each covariate as a smooth function, letting the data determine the linearity or non-linearity of the relationships.

Let us denote the generic Italian region as s=1, …, 20 and the generic year from 1998 to 2019 as t=1, …, 22. Also, let y_{st} be the household expenditure on health care for region s and time t. The GAM can be expressed as follows:

- share of people over 80 years old (% of the total population) (Processing of Istat data on the resident population: http://dati.istat.it/)
- the average amount of patience per doctor (Indicator code 7013)
- rate of integrated home care assistance for people over 65 years old (Indicator code 7023)
- rate of drug consumption for the whole population (Indicator code 7410)

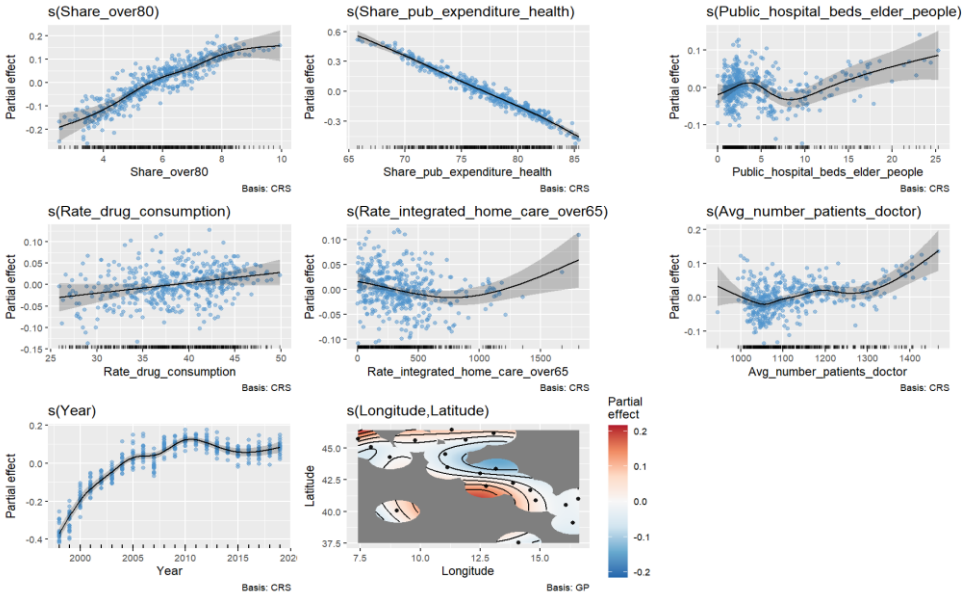
$$\begin{aligned}\log[E(y_{st}|X_{st})] = \ & \beta_0 + f_1(Share\_over80_{st}) \\ & + f_2(Share\_pub\_expend\_health_{st}) \\ & + f_3(Public\_hospital\_beds\_elder\_people_{st}) \\ & + f_4(Rate\_drug\_consumption_{st}) \\ & + f_5(Rate\_integrated\_home\_care\_over65_{st}) \\ & + f_6(Avg\_number\_patients\_doctor_{st}) + f_7(Year_t) \\ & + f_8(Longitude_s, Latitude_s)\end{aligned} \quad (1)$$

where $y_{st} \sim Gamma$ and $f_j(x_j)$ with j=1,…,8 are smooth functions relating the covariate x_j with the response variable. Notice that $f_j(x_j)$ with j=1,…,7 are univariate smooth functions modelled as cubic regression splines, whereas f_8 is a bivariate smooth function describing the spatial trend through a Gaussian Process smoother with exponential covariance function.

4. Results

In Figure 4, we represent the partial effects of each covariate on household expenditure in health care. Partial effects can be interpreted as the contribution of each covariate to the prediction of the response variable when other covariates are held constant at their most typical value (i.e., the mean).

Figure 4 – *Estimated partial effects between household expenditure and each variable.*



The main findings can be summarised as follows:

- There is evidence of a statistically significant positive and almost linear relationship between the share of elderly people over 80 years old and private expenditure. Thus, household expenditure is directly proportional to the ageing of the population. This indicates that the burden of ageing is loaded (at least partly) on private expenditure;
- As the share of public expenditure on healthcare increases, private healthcare expenditure decreases proportionally and statistically significant. Considering that after 2008 the share of public health expenditure has fallen considerably (both at local and national levels), while private expenditure has been rising continuously, it seems clear that households are increasingly burdened with the cost of healthcare;
- the number of patients has a non-linear effect on private expenditure: estimates indicate that only when the average number of patients per doctor exceeds 1300 does healthcare expenditure appear to increase significantly. The estimate of 1300 patients per doctor could be interpreted as a critical threshold for the saturation of the healthcare system;
- the spatial trend suggests a 'Rome Capital effect' in which central Italian regions have higher household expenditure than the rest of the country.

5. Final remarks and further research

The model describes a nation divided by varying degrees of 'fatigue' in the national health care system. The most overstressed area is central Italy, probably influenced by the high degree of urbanisation of the capital city Rome.

By examining the data available through the implemented model, it has become clear that the pressure on the healthcare system is increasing in the face of an ageing population. However, the tendency to rationalise healthcare expenditure through mechanisms such as the reduction of geriatric beds and the increased use of ADI is only shifting more expenditure commitments in the healthcare chapter onto households. Again, considering the increased pressure on family doctors, it seems safe to say that the State has not yet managed to achieve the desired results in reorganising the healthcare system and is currently struggling to meet the growing demand for assistance from citizens.

Continuing along this path, the models used could be used to develop future scenarios regarding household expenditure on healthcare, as they could also be supported by analyses conducted using spatio-temporal autoregressive models such as CARs, for example. Finally, the opportunity to include further explanatory variables and to study the phenomenon at a finer territorial level could be considered.

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CHANGING FAMILY MODELS THE CASE OF THE PUGLIA REGION[1]

Raffaella Rubino, Arjeta Veshi

Abstract. Profound demographic and social transformations have affected our country, triggering a gradual reduction in family size. In Italy, the increasing number of families[2] has corresponded to a progressive decrease in their size, with an increase in single-person households and a contraction of larger ones.
Southern Italy stands out for having experienced a more rapid reduction in the number of family members compared to other parts of the peninsula, as it has gone from 2.7 to 2.5 members per family in the last ten years. Therefore, it was considered essential to investigate this phenomenon, with a focus on Puglia as it represents the typical region in that geographical area.
The analysis is based on Istat data, which allow for the reconstruction of the framework of this study, drawing from a wealth of information on individuals, families, and territorial data for Italian regions. However, the complexity of interpreting demographic and social phenomena and their interplay has made it necessary to also utilize other comprehensive sources. This study observes the demographic trend related to the aging of the population within the realm of family size and structure in Puglia, through a retrospective analysis of the past ten years (2013-2022) and a prospective analysis for the next twenty years (2021-2041). The longitudinal observation pays particular attention to the phenomenon of increasing families with at least one member over the age of 60.
Furthermore, the comparison between the population in 2021 and the projected population in 2041 shows the demographic and social changes expected in the next twenty years, including models of single-person households with a predominantly female connotation.

[1] Although the contribution is the joint responsibility of the authors, sections 1 and 2 is attributed to Arjeta Veshi, the sections 3-4-5 is attributed to Raffaella Rubino.
[2] A family can coincide with a nucleus, it can be formed by a nucleus plus other aggregated members, by multiple nuclei (with or without aggregated members), or by no nucleus (individuals living alone, families composed, for example, of two sisters, a parent with a separated, divorced, or widowed child, etc.). Quoted from 'LA VITA QUOTIDIANA. ANNO 2011'.
[Source: https://www.istat.it/it/files/2012/07/glossario_.pdf]

1. Introduction

Social and cultural transformations initiated in the post-war period have led to profound changes in the processes of family formation. This process is influenced by the delay in milestones (leaving the family of origin, forming a union, arrival of the first child) and the emergence of new forms of family life. There is an increasing trend in incomplete trajectories and those characterized by free unions or periods of independent living, and as a result, family formation paths are more diversified than in the past.

Families, like the population, are essential for understanding the territory and serve as a reference variable for administrations. The key elements useful for defining the most appropriate intervention policies are represented by the characteristics of families in terms of size and type.

This study focuses on the gradual aging of the population in relation to family transformations in terms of size and type. The past decade marks a transition towards a significant increase in the number of single-person families composed of adults. The contraction of the number of family members, particularly evident in southern Italy, is a phenomenon worthy of further investigation. Puglia is the region of reference as it presents the average rates for the entire southern region.

The characteristics of families are also related to a range of economic, social, and cultural phenomena. Consider, for example, the changing intergenerational relationships that often lead to the splitting of family units or the dynamics of the housing market, which, reinforced by employment difficulties, have discouraged the formation of new households, and so on. The prospective analysis for geographical regions, with a particular focus on the Puglia region, aims to represent the possible future trends of the population, both in terms of the number of families and their age and gender structure.

2. Sources and method

The research aims to monitor the demographic trends related to the aging of the population within the context of family structure in Puglia, with a particular focus on the phenomenon of an increasing number of family units composed of individuals over the age of 60, using a longitudinal[3] and interdisciplinary methodology.

The Istat data allows us to reconstruct the framework of this study, leveraging the wealth of information available on individuals and families, as well as territorial

[3] Thanks to the longitudinal methodology, also known as diachronic, it is possible to collect data related to the variation of one or more factors at different times in an individual's life.

reconstructions of Italian regions[4]. However, the complexity of interpreting demographic and social phenomena and their interplay has made it necessary to also utilize other comprehensive sources. The reference time spans from 2013 to 2041, with a retrospective analysis (2013-2021) and a prospective analysis (2021-2041).

This analysis is valuable for understanding the current situation and for better shaping scientific analysis and policy action. The goal is to provide the most comprehensive overview possible of the aging and transformation process of Italian families, with a specific focus on the Puglia region.

3. Retrospective analysis: Italy, geographical divisions, and Puglia

In Italy, as of December 31, 2021, there were 26,206,246 families, with an average size of 2.2 members compared to 2.6 members that constituted the family just twenty years ago.

This trend is consistent throughout the national territory, with the exception of the southern part of Italy – particularly the region of Puglia – which shows a greater contraction in the number of family members (table 1).

Table 1 - *Family members in Italy distributed by geographical division. Average years 2013-2022.*

Years	Italy	North-west	North-east	Centre	South	Islands	Puglia
2013	2,4	2,3	2,4	2,4	2,7	2,5	2,7
2014	2,4	2,3	2,4	2,3	2,6	2,5	2,6
2015	2,4	2,3	2,4	2,3	2,6	2,5	2,6
2016	2,4	2,3	2,3	2,3	2,6	2,5	2,6
2017	2,4	2,2	2,3	2,3	2,6	2,5	2,5
2018	2,3	2,2	2,3	2,3	2,6	2,4	2,5
2019	2,3	2,2	2,3	2,3	2,6	2,4	2,5
2020	2,3	2,2	2,3	2,3	2,5	2,4	2,5
2021	2,3	2,2	2,3	2,3	2,5	2,4	2,5
2022	2,2	2,2	2,3	2,3	2,5	2,4	2,4

Source: Istat, Multipurpose survey "Aspetti della vita quotidiana"

In Puglia, as of December 31, 2021, there were 1,635,899 families, accounting for 6.2% of the national total, with an average size of 2.4 members, slightly higher than the national average (2.2 members). This distribution is consistent across the regional territory, except for the province of Barletta-Andria-Trani (2.5). As the

[4] Multiscopo on families: aspects of daily life.

number of family members progressively decreased, there was an increase in the number of families (table 2).

Table 2 - *Family members in Puglia distributed by geographical division. Biennial average 2021-2022.*

Territory	Number of families	Average family members
Italy	26.206.246	2,2
Puglia	1.635.899	2,4
Foggia	248.993	2,4
Bari	502.464	2,4
Taranto	237.027	2,3
Brindisi	162.002	2,3
Lecce	336.897	2,3
Barletta-Andria-Trani	148.516	2,5

Source: Istat, Multipurpose survey "Aspetti della vita quotidiana"

Single-person households, which now account for one-third of the total number of families (33.2%), have increased by almost 10 percentage points compared to the period 2001-2002 (24%). On the other hand, even large families - those with five or more members - which now represent just over 5% of the total, have shown a significant decline, decreasing from 7.1% in the 2001-2002 biennium to the current 5.1%.

Table 3 - *Family Types in Italy, Years 2013-2022. Absolute values.*

Tipology	2013	2016	2019	2022
Families without a nucleus	7981	8552	9154	8979
Individuals living alone	7474	8016	8562	8363
Families with a nucleus	16455	16466	16165	15951
A nucleus without other individuals	15607	15646	15303	15164
- Childless couples	4820	4928	4791	4861
- Couples with children	8573	8442	8114	7828
- Single parents with children	2214	2276	2397	2475
A nucleus with other individuals	848	820	863	788
- Childless couples	258	266	261	252
- Couples with children	391	365	382	314
- Single parents with children	198	189	220	221
Families with two or more nuclei	360	368	396	333

Source: Istat, Multipurpose survey "Aspetti della vita quotidiana"

During the last decade, the share of single-person households has increased from 23.3% to nearly 30%. The share of couples without children has also increased. On the other hand, there has been a decrease in the percentage of households composed of parents with children, as well as in the percentage of families with more than 5

members and those composed of multiple households. Regarding family composition, on average in the biennium 2021-2022, nearly 1 in 3 families (28.7%) consists of individuals living alone, with a lower incidence compared to the national data.

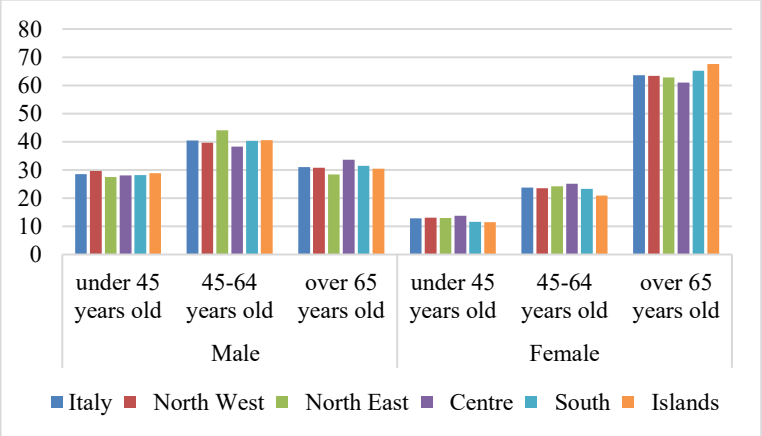
Table 4 – *Family Types in Puglia. Biennial average 2021-2022.*

Tipology	Puglia	Italia
Families without a nucleus	30.7	35.5
- Individuals living alone	28.7	33.1
Other families	2.0	2.4
Families with a nucleus	67.7	63.1
- Single parents with children	10.0	10.7
- Couples with children	37.7	32.2
- Childless couples	20.0	20.2
Families with two or more nuclei	1.6	1.4
Total	100.0	100.0

Source: Istat, Multipurpose survey "Aspetti della vita quotidiana"

Single-person households, especially due to their age composition, have significant social implications: as individuals age, the number of people living alone increases. While there are no substantial changes in the proportions for men as they age, there is a significant increase in the percentage of women over 65 living alone throughout Italy. From a geographical perspective, the highest incidence of single-person households is observed in the South (Figure 1).

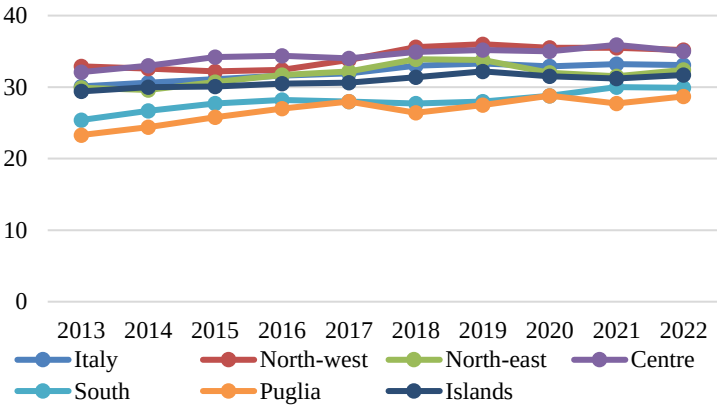
Figure 1 - *Single-person households in Italy distributed by geographical division, age group, and gender. Biennial average 2021-2022.*



Source: Istat, Multipurpose survey "Aspetti della vita quotidiana"

During the last 10 years, there has been a particular increase in the proportion of individuals over 60 living alone in Puglia compared to the average of other Italian geographical divisions. Considering that the number of residents over 75 is also growing at a higher rate compared to the national average, families without a nucleus composed of elderly individuals represent a developing reality (figure 2).

Figure 2 – *Single-person households over 60 distributed by geographical division. Average years 2013-2022.*



Source: Istat, Multipurpose survey "Aspetti della vita quotidiana"

The *Mezzogiorno* of Italy, including the islands, has the highest percentage of individuals over 60 living alone. Specifically, in the region of Puglia, 74.5% of this category consists of women, which is the highest proportion compared to the southern regions.

4. Prospective analysis: Italy, geographical divisions, and Puglia

The family projections (based on January 1, 2021), developed through a semi-probabilistic approach, cover the period from January 1, 2021, to January 1, 2041. The results confirm the potential crisis scenario, as it is projected that the number of families will increase by approximately one million units in twenty years: from 25.3 million in 2021 to 26.3 million in 2041 (+3.8%). These families will be increasingly

smaller, characterized by greater fragmentation, with the average number of members decreasing from 2.3 in 2021 to 2.1 in 2041[5].

Different family types respond to demographic dynamics and social behaviours that characterize different areas of the country, with more pronounced differences between the North and the South. In 2021, the proportion of families with at least one nucleus is lower in the North compared to the *Mezzogiorno*. By 2041, this type of family could constitute 58% of the total families in the North and 61% in the south, representing a reduction of 6 percentage points in both cases. In the centre, families with a nucleus would also experience a similar reduction, around 5 percentage points, constituting 57% of the total families.

Table 5 – *Family members and number of families distributed by geographical division. Average years 2021-2026-2031-2036-2041.*

Year	Italy	North West	North East	Centre	South	Islands	Puglia
2021	2,32	2,22	2,32	2,26	2,49	2,4	2,49
2022	2,31	2,21	2,31	2,25	2,48	2,39	2,48
2023	2,3	2,2	2,3	2,25	2,47	2,38	2,46
2024	2,29	2,19	2,29	2,24	2,45	2,36	2,44
2025	2,28	2,18	2,28	2,23	2,44	2,35	2,43
2026	2,27	2,17	2,27	2,22	2,42	2,33	2,41
2027	2,26	2,16	2,26	2,21	2,4	2,32	2,4
2028	2,25	2,15	2,25	2,2	2,39	2,31	2,38
2029	2,24	2,15	2,24	2,19	2,37	2,29	2,36
2030	2,23	2,14	2,23	2,18	2,36	2,28	2,35
2031	2,22	2,13	2,23	2,17	2,34	2,26	2,33
2032	2,21	2,12	2,22	2,16	2,33	2,25	2,32
2033	2,2	2,11	2,21	2,16	2,31	2,24	2,3
2034	2,19	2,1	2,2	2,15	2,3	2,23	2,29
2035	2,17	2,09	2,19	2,14	2,28	2,21	2,27
2036	2,17	2,09	2,18	2,13	2,27	2,2	2,26
2037	2,16	2,08	2,17	2,12	2,26	2,19	2,25
2038	2,15	2,07	2,17	2,11	2,25	2,18	2,24
2039	2,14	2,07	2,16	2,11	2,24	2,17	2,22
2040	2,13	2,06	2,15	2,1	2,22	2,16	2,21
2041	2,12	2,05	2,14	2,09	2,21	2,15	2,2

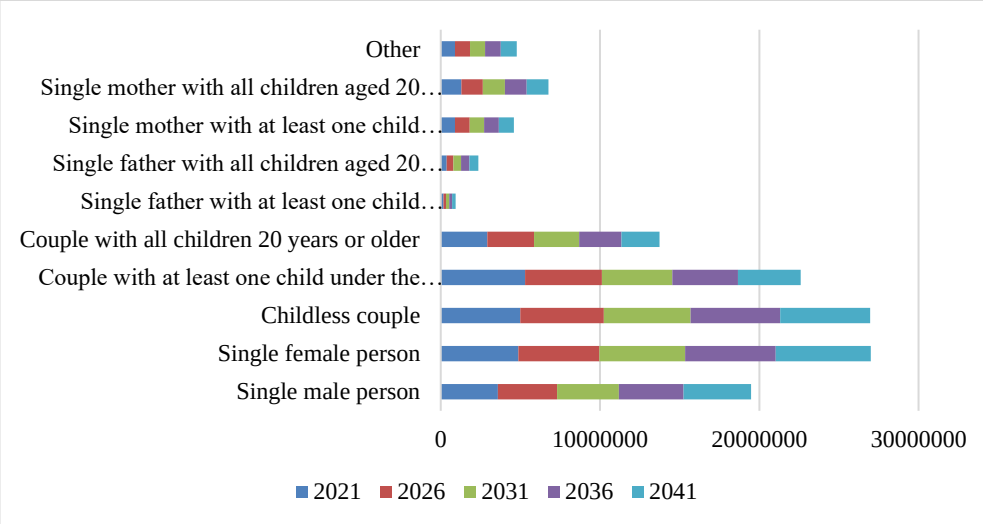
Source: Istat, Multipurpose survey "Aspetti della vita quotidiana"

The family type "couple with children" is expected to undergo the most significant change in the next twenty years. In the south of Italy, a decline of about nine percentage points is expected (from 37% in 2021 to 28% in 2041), while in the North (from 31% to 23%) and in the centre (from 30% to 22%), the decline is

[5] Istat (2022). *Previsioni della popolazione residente e delle famiglie – base 1.1.2021*. Statistiche Report, settembre 2022. www.istat.it.

approximately eight percentage points[6]. Therefore, the *Mezzogiorno* would still maintain a higher proportion of couples with children. Most of the reduction in the "couple with children" type of family is related to couples with at least one child under the age of 20, compared to couples with only adult children aged 20 and above. In the North, the former type decreases from 21% in 2021 to 16% in 2041 (a decrease of 5 percentage points out of the total 8 lost by couples with children, regardless of their children's ages), in the centre from 19% to 13% (a decrease of 6 out of 8 points overall). In the south of Italy, the projections indicate a broader demographic crisis. Here, couples with at least one child under the age of 20 would decrease by seven percentage points out of the total nine lost by couples with children. Therefore, there is a convergence process for couples with "young" children. However, the same cannot be said for couples with older children, where there is still a difference in favour of the *Mezzogiorno*, partly due to the longer time spent in the family of origin in this part of the country[7]. Single-person households (individuals living alone) will represent nearly 40% of the total families, increasing by approximately 7 percentage points compared to the current data (33.2%). The proportion of couples without children (21.5%) will also increase. Couples with children, on the other hand, will decline, while single parents with children will experience moderate growth, especially among males.

Figure 3 – *Family Types in Italy. Absolute values years 2021-2041.*



Source: Istat, Multipurpose survey "Aspetti della vita quotidiana"

[6] *Ibidem.*
[7] *Ibidem.*

In Puglia, along with the progressive contraction of the number of families, there is a decrease in the number of family members. Specifically, single parents, individuals living alone, and couples without children are increasing, while couples with at least one child are decreasing.

The comparison between the population in 2021 and the projected population in 2041 demonstrates that demographic and social changes will result in new family patterns over the next twenty years, characterized by single-person households, and a feminized connotation.

In Italy, if already in 2021, the proportion of individuals aged 65 and over living alone represents half of those living alone, by 2041 it would reach 60%. In absolute terms, the number of individuals living alone would reach 10.2 million (+20%), of which 6.1 million would be aged 65 and over (+44%)[8].

In Puglia, along with the progressive contraction of the number of families, there is a decrease in the number of family members. Specifically, single parents, individuals living alone, and couples without children are increasing, while couples with at least one child are decreasing.

Table 6 – *Family Types in Puglia. Projection years 2021-2041 in percentage values.*

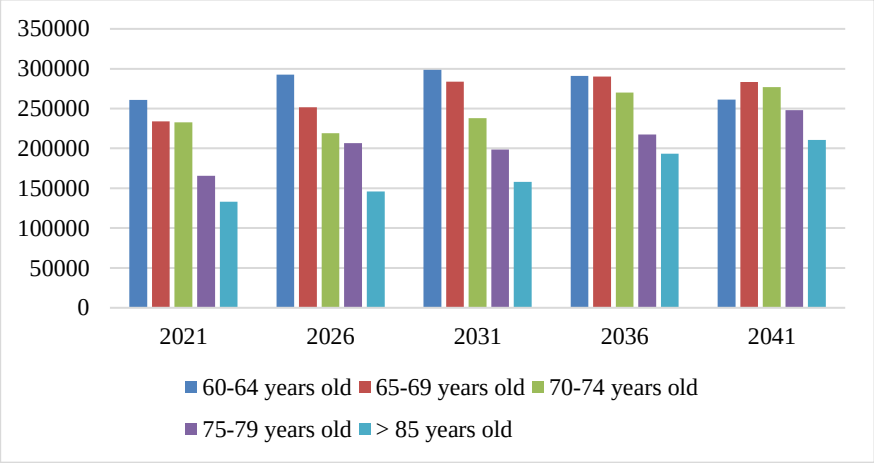
Tipology	2021	2026	2031	2036	2041
Individuals living alone	29,2	30,3	31,9	33,7	35,4
Childless couples	19,8	20,9	21,7	22,3	22,6
Couples with children	38,9	36,7	34,1	31,7	29,6
Single parents with children (father)	1,5	1,6	1,7	1,9	2
Single parents with children (mother)	7,9	8	8	7,9	7,9
Other	2,6	2,5	2,5	2,5	2,4

Source: Istat, Multipurpose survey "Aspetti della vita quotidiana"

In Puglia, by 2041, the average age will be 50.7 years compared to the current 45.4 years, and approximately 34.5% of the population will be composed of individuals aged 65 and over, of which 84.3% will be living alone. Among these individuals living alone, there is observed a growth over time, especially among those aged 70 and over and those aged 85 and over. Most of these individuals are women.

[8] *Ibidem.*

Figure 4 – *Projection of single-person households over 60 in Puglia by five-year age groups, 2021-2041.*



Source: Istat, Multipurpose survey "Aspetti della vita quotidiana"

5. Final remarks

The exploratory nature of this study allows us to observe how population aging, increased life expectancy, declining fertility rates, and decreased birth rates have resulted in a higher number of individuals living alone as a long-term consequence of social, demographic, and economic dynamics.

The connection between family aging and the potential aging of society lies in the fact that phenomena and behaviours strongly vary with age: learning, producing, consuming, getting married, procreating, migrating, dying, etc.

It is, therefore, significant that the projected average age of the population by 2041 is 50 years, and there is an increasing trend in single-person households with a female connotation.

In the coming decades, we will not only witness a progressive increase in population aging (also influenced by the decrease in the population of Puglia in favour of the elderly population), but also a substantial decline in the working-age population and a progressive increase in single-person households with a female connotation. This aspect will highlight the issue of structural sustainability related to the increasing social and economic burden on the working-age population, which is responsible for supporting the non-active population.

In the future, it will be necessary to differentiate policies according to different territories. For example, particular attention could be given to social care services,

with an increasing focus on services for individuals over 85, at the expense of those designed for early childhood.

The future projects us into a society where family networks will become less numerous, and individuals will tend to live in solitude. Furthermore, the probability of living alone increases with age and affects females to a greater extent.

The loneliness of the elderly, which until a few years ago was considered a critical issue, now requires a positive reinterpretation. We must consider the needs of the growing elderly population, not only in terms of social protection policies but also as policies for activity, economic development, and cultural advancement.

This issue could have a positive impact on the quality of life of the elderly (psychologically and economically) and the family (psychologically and culturally), strengthening their bonds and relational values. The political mission should, therefore, focus on incentivizing the sustainability of the collective solidarity system through institutionalized forms.

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MARRIAGES OF SPOUSES WITH A MIGRATORY BACKGROUND: FOCUS ON "NEW ITALIANS"[1]

Antonella Guarneri, Claudia Iaccarino, Maura Simone

Abstract. The advanced path of integration of migrants in Italy makes it increasingly difficult to measure family behaviours by type of couple. The aim of the following work is to analyse marriages with at least a spouse with migratory background by studying the type of couple in a "dynamic" way (considering the citizenship both at the time of birth and at the time of marriage). The data are from the Italian National Institute of Statistics (ISTAT) Survey on marriages, celebrated in Italy, validated also by using the integration with ISTAT estimates of citizenship acquisitions. Through descriptive analysis we compared the profiles of foreign citizens, new Italians and Italians by birth distinguished by gender. A particular focus is on the combination of the socio-demographic characteristics of the couple (e. g. age gap). Age-assortative mating patterns show clear differences by gender and citizenship. For intermarriages where the groom is Italian by birth, we observe the highest age gap (9 years, over 4 years more compared to the total of marriages); when the groom is a new Italian, on the contrary, the age gap drops to 6.2 years.

1. Introduction

The growing degree of "maturity" of immigration in Italy makes it increasingly difficult to measure family behaviours by type of couple. As we move forward in the integration process one of the most advanced steps is the acquisition of citizenship. In this way, however, it becomes more difficult to identify mixed couples considering only citizenship at the time of the event rather than at birth. Hence the classic Italian/foreigner dichotomy is fully joined by the "new" segment of Italian citizens of foreign origin.

After an increasing trend in acquisitions of citizenship, a small setback occurred in 2021: 121,457 citizenship acquisitions registered in Italy (about 8% less than in 2020) in part presumably attributable to the "long-term" effects of the pandemic by COVID-19. Today we are witnessing a progressive decrease in acquisitions by

[1] The article is exclusively expressing the authors' opinions. Although the paper is the result of joint work, sections are attributed as follows: paragraphs 1, 4 and 6 to Antonella Guarneri, paragraphs 3.2 and 5 to Claudia Iaccarino and paragraphs 2 and 3.1 to Maura Simone.

marriage (from almost 36% among those who became Italian citizens before 2011, to 12.0% in 2021) and indeed, more and more often, the acquisition of citizenship precedes marriage. In general, women represent 50.7% of those who have acquired Italian citizenship in 2021 but they reach over 82% among those who obtained it through marriage.

In this work we analysed the data from the Italian National Institute of Statistics (ISTAT) Survey on marriages, an individual and exhaustive survey, which covers all marriages celebrated in Italy. For the first time in 2021 the information on Italian citizenship (from birth or by acquisition) was validated also by using the integration with ISTAT estimates of citizenship acquisitions.

The choice of partner is determined by both individual preferences and contextual factors (Kalmijn, 1998). But the marriage market also influences the choice which depends, in fact, on the availability of potential partners with similar socio-economic and cultural characteristics (De Rose and Fraboni, 2015; Kulu and Hannermann, 2016). Patterns of age-assortative mating that appears similar to those found in native-native marriages may reflect openness to foreign counterpart, whereas when they are more ascribable to status exchange theory, closely related to the notions of attractiveness in the marriage market, status considerations are important determinants of intermarriage in the native marriage market (Elwert, 2020).

Mixed marriage can be conceptualized as an indicator of integration (Tognetti Bordogna, 2019). Furthermore, getting married to a native and then acquiring the citizenship of the host country can certainly make easier entry into the labour market and into the host society. However, it is not always true that the wedding takes place after an integration process; it could rather signal a request for integration by attributing to marriage the specific role of sanctioning a formal type of integration (Azzolini and Guetto, 2017). This request for integration takes on an even different meaning if the mixed marriage concerns a foreign citizen and an Italian one by acquisition (Guarneri *et al*., 2021).

The aim of the following work is to analyse marriages with at least a spouse with migratory background by studying the type of couple in a "dynamic" way; to this purpose we consider the spouses' citizenship at the time of birth and at the time of marriage according to some specific characteristics such as age differences between spouses and their places of residence.

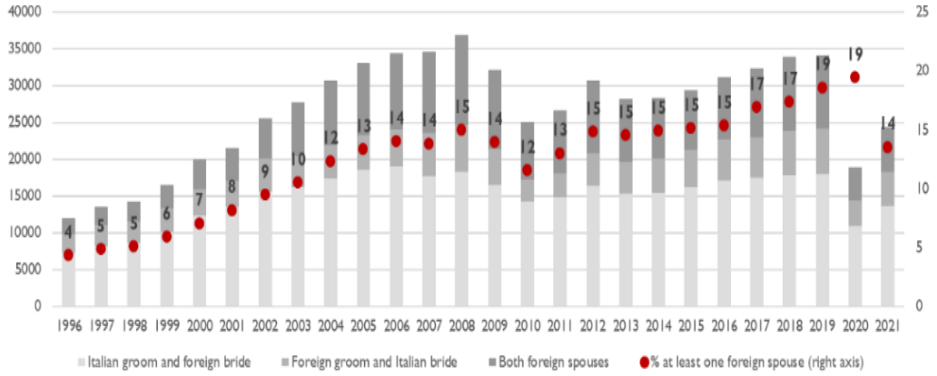
This analysis is a part of a more general research project that aims to study, in a longitudinal perspective, the paths for acquiring citizenship, focusing not only on marriages but also considering further events such as the birth of a child or the dissolution of the marriage. The idea is, therefore, to reconstruct and analyse, through the integration of archives, the sequence of stages of the main family and

reproductive behaviours of foreign-born citizens in Italy. This project belongs to the same line of analysis carried out by previous ISTAT projects[2].

2. The marriages with at least one foreign spouse in Italy

In the last decades, in Italy the phenomenon of marriages with spouses with foreign background has grown. From 1996 to the beginning of the new millennium, the percentage of marriages with at least one foreign spouse on the total of marriages is almost constantly increasing, from 4.3% to the peak observed in 2008 (15.0%). In the following two years (2009-2010) a particularly marked decrease was observed due to the collapse of foreign citizens' marriage, discouraged by legislative changes aimed at limiting marriages of convenience[3]. Overcome these negative effects, since 2011 the share of marriages between foreigners starts growing again (Figure 1).

Figure 1 – *Marriages with at least one foreign spouse, by spouses' citizenship. Italy, years 1996-2021 (absolute values and percentage values).*



Source: Elaborations on ISTAT data

2 In the ISTAT project "Reception, integration and citizenship: new approaches for the analysis of migratory paths and models" marriages for type of couple were studied (considering not only the citizenship at the event but also that at birth); the results of this project were harmonized with those of the ISTAT project "A measure of Italian emigration through the integration and analysis of administrative data".

3 In order to prevent the celebration of marriages of convenience the article. 1 paragraph 15 of law no. 94 of July 2009 has modified the art. 116 of the Italian Civil Code having effects not only to mixed marriages but also to marriages with both foreign spouses. In July 2011, the Constitutional Court, with sentence n. 245/2011, considered constitutionally illegitimate this reformed article, limited to the words "as well as a document attesting the regularity of the stay in the Italian territory".

In 2021, 24,380 marriages were celebrated in Italy with at least one foreign spouse: of these, 24.9% are both foreigner, 56.2% with an Italian groom and a foreign bride, 18.8% with a foreign groom and an Italian bride (ISTAT, 2023). The number of these marriages is in clear recovery compared to 2020 (+29.5%), in which many couples had been forced to postpone their weddings, because of a period of suspension of civil and religious ceremonies, due to the pandemic by COVID-19.

A particular aspect that characterizes our country is the so-called "wedding tourism". Italy exerts a strong attraction for many citizens from abroad, especially from most developed countries, who choose Italy as a place of celebration of their marriages. In 2020, because of restrictions on international movements due to the spread of COVID-19, marriages with both non-resident in Italy foreign spouses have fallen by 77.6%.

Net of this particular segment, marriages with both foreign spouses in 2021 were 4,508, on the increase compared to 2020 (+25.5%), but not sufficient to be back to pre-COVID levels (-23.9% to 2019). Mixed marriages or intermarriages (in which one spouse is Italian and the other one is a foreigner) amount to over 18 thousand and continue to represent the largest part of marriages with at least one foreign spouse (75.1%). In mixed couples, the most frequent type is that in which the groom is Italian, and the bride is from abroad; this type of marriage concerns 7.6% of the total number of celebrations at the national average level (13,703 weddings celebrated in 2021). The Italian women who chose a foreign partner were 4,595, 2.5% of the total brides. The cases with both foreign spouses were 6,082 (3.4% of total marriages).

3. Data and methods

3.1 Data sources

To show the first results of the new research project, the analysis is carried out using data collected from the Survey on marriages. The survey, conducted since 1926 by ISTAT, provides the official data of all marriages (religious and civil) celebrated in all Italian municipalities; these data are collected at the time of the formation of the Marriage Act (according to the provisions of the Civil Status regulation contained in the Presidential Decree of 3 November 2000, No. 396).

The availability of this database represents a great opportunity for many reasons. First, the characteristics of the data, individual and exhaustive, allow analysing the phenomenon of nuptiality, by marriage order, in relation to the main socio-demographic characteristics of the spouses. Second, the integration with other ISTAT sources (e.g. Estimates of Italian citizenship acquisitions) offers the

possibility of widening the information potential. Third, the availability of a historical data series allows analysis in a longitudinal perspective. Finally, a more disaggregated territorial classification if compared to sample surveys can be considered.

All these aspects have allowed us to analyse marriages with at least a spouse with migratory background by studying the combinations of citizenships in a "dynamic" way (for each spouse at the time of birth and at the time of marriage). Among intermarriages, over one in 10 involves an Italian spouse by acquisition; if we consider mixed marriages between Italian bride and foreign bridegroom, in one out four the Italian bride shows a foreign origin.

The significant increase in the presence of Italians by acquisition at the time of marriage is due to multiple factors. First, in recent years the acquisition has become more substantial, in line with a more advanced process of integration of foreign citizens, but, at the same time, there is a progressive decrease in the share of acquisitions by marriage. The type of mixed marriage, therefore, is changing over time, including a growing share of new Italian citizens who at birth had the same citizenship as the foreign partner.

3.2 Methods

The citizenship of the spouses, as mentioned, is one of the characteristics detected by the ISTAT Survey on marriages. It is possible to distinguish between Italian citizenship by birth and by acquisition. This information, nevertheless, in some cases is underestimated for lack in the data collection process. In order to overcome this underestimation, the estimates deriving from the elaboration ISTAT "Acquisitions of citizenship" have been used. These estimates came from a database built on the basis of the stock 2011 individual census data, the data on the type of acquisition from Ministry of Interior and the data of the new micro-demographic accounting information system. In a previous research (Strozza *et al.*, 2021), the analyses were conducted through data linkages between the 2012-2020 marriages' data with this database. This integration made it possible to identify the foreign resident citizens at birth and to observe, following a longitudinal approach, whether or not they have acquired Italian citizenship over time and more specifically got married after 2011.

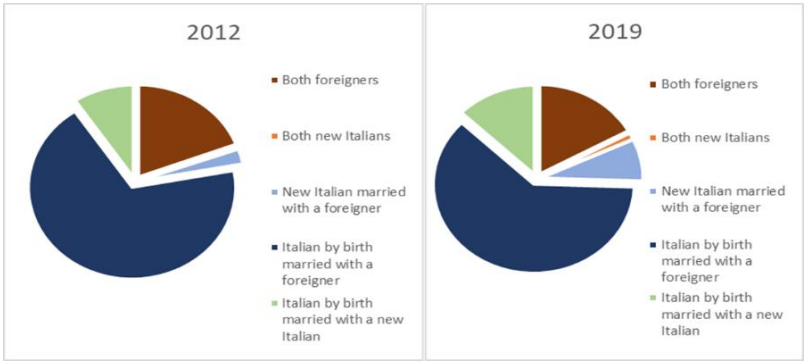
Going on this approach, the main analyses refer to the 2021 marriages' data collection, integrated with ISTAT estimates of citizenship acquisitions, updated to 1st January 2021. Through this integration it was possible either retrieving the information when it was missing or comparing the data and, possibly, correct them, when the information was present. In 2021 it was possible to correct more than 90% of cases where the data was not available, or it was incorrect.

Descriptive analyses have been performed to compare the profiles of foreign citizens and new Italians distinguished by different covariates as sex, age and residence. A particular focus has concerned the combination of the socio-demographic characteristics of the couple (e.g., age gap). A differential analysis allowed us to highlight the main peculiarities by type of couple (with the distinction also between Italian by birth and new Italian).

4. Considering citizenship in a dynamic way: first insights

The possibility of distinguishing the citizenship of Italian spouses, by birth or by acquisition, allows us to shed light on nuptial behaviour based on the migratory background (Figure 2).

Figure 2 – *Marriages with at least one foreign-born resident by type of couple. Italy, years 2012 and 2019 (percentage values).*



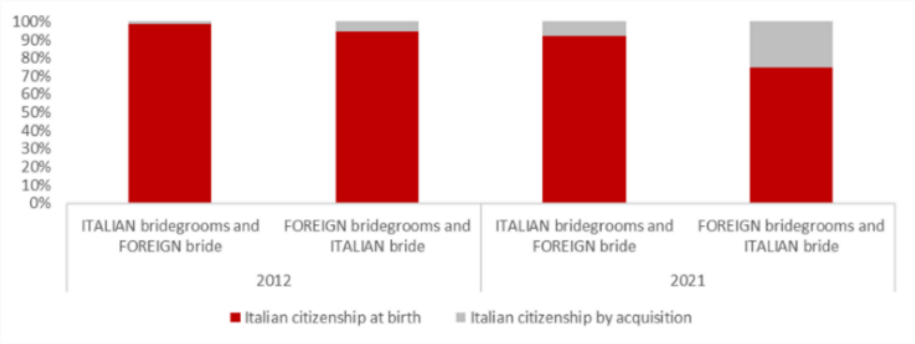
Source: Strozza, Conti and Tucci 2021; elaborations on ISTAT data.

As a previous result the great effort of combining the data updated to 1st January 2020 of the acquisitions of citizenship (in a longitudinal perspective) with the information provided by the marriage archives (from 2011 to 2019) was very fruitful.

Comparing the citizenships of the spouses who got married in 2012 with those of 2019, the first element to consider is, on one hand, the decrease in the share of both Italian spouses since birth, which goes from 85.6 to 80.6 %; as well as is decreasing also the share of marriages between both foreign spouses (from 19.2 to 17.0%) and that of marriages between an Italian spouse from birth and a foreigner (from 68.6 to 61.7%). On the other hand, couples with both Italians by acquisition are growing (from 0.3 to 1.0%), those with a new Italian and a foreigner (from 2.5 to 7.5%) and, finally, those with Italian from birth and Italian by acquisition (from 9.4 to 12.8%).

Continuing on this path with the most recent data, among mixed marriages over one in 10 involves an Italian spouse by acquisition in 2021 (Figure 3).

Figure 3 – *Mixed marriages by type of couple and citizenship. Italy, years 2012 and 2021 (percentage values).*



Source: Elaborations on ISTAT data.

It is possible to refine the study by considering another aspect such as the gender dimension. As a matter of fact, if we consider mixed marriages between Italian and foreign bridegroom, in one out of four cases the Italian bride is foreign-born. This share was much lower, about 6%, in 2012.

5. Main Results

5.1 The age gap

Previous research analysed the age gap between spouses in mixed couples. These studies represent a situation where mixed marriages are usually more heterogamous relative to age (Elwert, 2020) and are often characterized by a larger age gap between partners (Stamper Balistreri *et al.*, 2017).

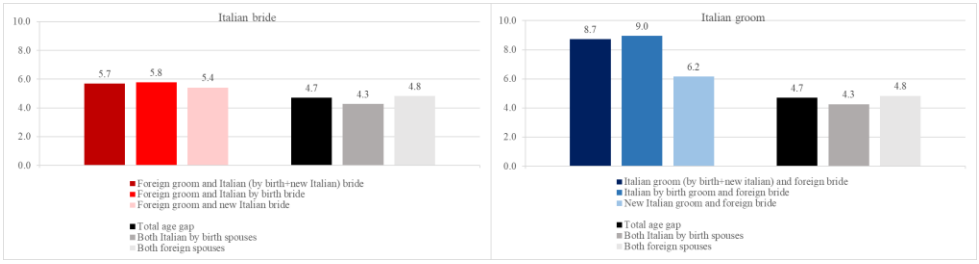
Different assortative mating patterns define a sort of "bargaining" between foreign and native partners: former' relative youth in exchange presumably of latter' social status and economic security (Gabrielli *et al.*, 2016).

One of the analyses that have been carried out concerns the age gap of the spouses, in relation to the type of couple. The goal was to analyse whether these same characteristics are also found in spouses who marry in Italy.

In a focus on the marriages with a foreign spouse, it is interesting to note that, in 2021, when the bride is Italian (by birth or new Italian), the age gap does not differ

much neither from the value calculated on the total of the spouses nor from the value calculated on couples with both foreign or both Italian spouses. In this case, in fact, the age gap is 5.7 years, not so far from 4.7 years, calculated on the total of marriages. The difference when the bride is Italian by birth and when the bride is a new Italian, moreover, is absolutely negligible (Figure 4).

Figure 4 – *Marriages with a foreign spouse. Italy, year 2021 (age gap in years).*



Source: Elaborations on ISTAT data

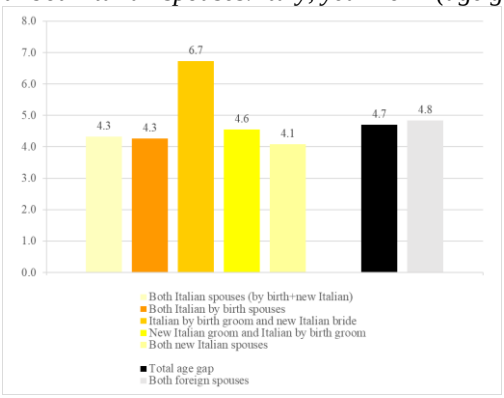
The situation, on the contrary, is very different if we focus on the couples in which it is the groom to be Italian. In this case the age gap is 8.7 years, about 4 years higher considering the age gap calculated both on the total of marriages and on the couples with both foreign spouses, 3.9 years if we consider the marriages with both Italian by birth spouses.

Focusing attention on Italian by birth grooms, the age gap reaches 9 years (over 4 years more compared to both the value calculated on the total of marriages and that of both foreign spouses). When the groom is a new Italian, on the contrary, the age gap drops to 6.2 years and the difference with the total number of marriages and with couples of both foreigners is reduced to just over a year.

A similar situation is found in couples with both Italian spouses: the age gap is below the value calculated on both all marriages and marriages with both foreign spouses. If, however, we also consider the migratory background, it is immediately evident that when the groom is Italian by birth and the bride is a new Italian, the situation changes. In this case, the age gap is about 2 years higher than the one calculated in the other types of couples (Figure 5).

It is therefore clear from this analysis how reductive it is to consider citizenship without taking into account the migratory history of individuals. It also seems to emerge that although the process of integration has reached an advanced step, as it is evident from having acquired Italian citizenship, behaviours, at least with regard to the phenomenon of marriage and particularly in the case of Italian men, are not yet fully in line with those of the host country.

Figure 5 – *Marriages with both Italian spouses. Italy, year 2021 (age gap in years).*



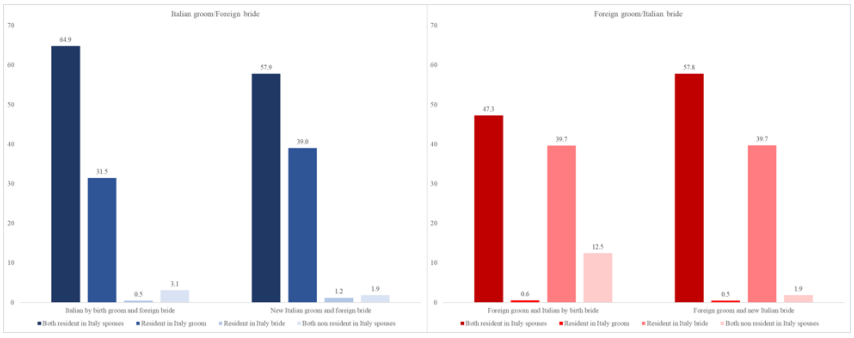
Source: Elaborations on ISTAT data

Age-assortative mating patterns here observed seem to confirm once more that a "variant" of the exchange theory can fit the Italian case (Maffioli *et al.*, 2014).

5.2 The residence in Italy

The residence in Italy was another relevant aspect to consider in this most general framework thinking particularly about transnational couples. When the spouses are both Italian, the residence in Italy does not seem to be affected by the Italian citizenship (by birth or by acquisition). On the contrary having a foreign citizenship seems to make the difference when there is at least a foreign spouse, the percentage reaches at most 65% (about 47.5% when the spouses are both foreigners) (Figure 6).

Figure 6 – *Mixed marriages by citizenship and residence. Italy, year 2021 (percentage values).*



Source: Elaborations on ISTAT data

Differently from the age gap, there are no substantial differences in the distinction between being Italian by birth or a new Italian. Focusing attention on couples with at least one foreign spouse and those in which both spouses are resident in Italy, it is possible to notice that when the groom is Italian, in most cases the couple resides in Italy, although with a decrease from 64.7 to 57.9 when you move from Italian citizenship by birth to Italian citizenship by acquisition.

The case in which the bride is Italian is different. In this case, only 47.3% of couples choose to live in Italy; a percentage that rises to 57.8% when the bride is a new Italian. In both types of couple, it seems that for women the marriage with a foreign groom often means to marry also his country of origin. For women, moreover, being a new Italian citizen has more weight, in choosing to stay in Italy, than being an Italian from birth.

6. Conclusions and further steps

By overcoming the Italian/foreigner dichotomous vision, the opportunity is offered to focus attention on the "new citizens" who represent a little-known portion of the population that bears characteristics and needs potentially different from those of both natives and foreign citizens (Strozza *et al.*, 2021). To achieve this goal the general idea is rebuilding in a longitudinal perspective, through the integration of archives, the family and reproductive behaviours of foreign-born citizens in Italy in the last decade, focusing attention on the sequence of steps that have characterized the path of integration of new citizens.

Another relevant point to think about concerns the indirect effects of the COVID-19 epidemic that are visible, with different times and intensities, on family and reproductive behaviours in the various European countries with differences and different intensity on the various segments of the population (ISTAT, 2021; Castagnaro and Prati, 2022); last but not least, the pandemic has also had repercussions on the process of acquiring citizenship itself, highlighting a slowdown (ISTAT, 2022). As further step the idea is monitoring on which type of couple the repercussions of the pandemic are more evident and with which potential repercussions (in terms of family behaviour and inclusion paths).

Lastly, always adopting a longitudinal perspective, it is possible to analyse how many foreign citizens acquire citizenship in the years following marriage updating previous analyses' results. Strong differences can be observed by type of couple, as well as by gender. The analysis by marriage cohort allows observing what happens in the following years in terms of citizenship acquisition (Guarneri *et al*., 2021).

The analysis of nuptial behaviours (and more in general of demographic and family attitudes) in connection with the acquisition of citizenship underlines the

importance of having statistics that adapt to the new social complexity and provide details that can contribute to the correct interpretation of the phenomena.

Acknowledgements

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A FORECASTING MODEL FOR THE ITALIAN LOCAL PUBLIC DEMAND AND EXPENDITURE OF SERVICES FOR THE SENIOR AGE. THE IMPACT OF DEMOGRAPHIC AGING[1]

Monica Carbonara, Agata Maria Madia Carucci, Giovanni Vannella

Abstract. This paper proposes the use of a forecasting model to estimate the Italian public spending on services for the elderly, which is affected by the demand change due to demographic aging that will affect Italy in the coming decades. This phenomenon is to be addressed both at a national level and at a territorial one, through an estimate of expenditure according to different scenarios of public policy choices characterized by a marked proactivity or a simple desire for equal distribution.

1. Introduction

The persistently low fertility that has characterized Italy in the last 40 years, combined with the higher survival rate, have led to the current Italian high aging process.

Future prospects will largely derive from the current breakdown by age of the population, and only to a lesser extent by the changes in the evolution of the fertility, mortality and migration dynamics. The strong aging together with the decrease of the population between 15 and 64 years, will force the public decision-maker and the entire production system to respond to the new needs of a completely changed population, in which it will be necessary to foresee more and more services dedicated to the elderly and the necessary resources for their supply/provision. This topic has been widely investigated by the literature that has examined the relative problems such as active aging (Barslund *et al.*, 2019; Capellari *et al.*, 2018) or social costs (Cerea, 2021; De Nardis and Alteri, 2012; Monteduro *et al.*, 2021).

This paper proposes an estimate of the number of users who in the next few years will require assistance services provided by the municipalities and the related public expenditure. To do so, we used a statistical economic forecast model applied to the data collected with the Survey on interventions and social services of

[1] Corresponding author: Giovanni Vannella, e-mail giovanni.vannella@uniba.it. Although this paper is the result of the joint work of the three authors, paragraph 2.2 is attributed to M. Carbonara, A.M.M. Carucci paragraphs 1, 2.3 and 4, to G. Vannella paragraphs 2.1, 3 and 5

individual and associated municipalities and on the basis of population forecasts to 2070 disseminated at regional level by ISTAT. In order to consider the effects of the autonomy of the regions in terms of service supply/provision, a comparison between different territorial areas with a specific focus on a divisional basis has been proposed.

2. Data

2.1. General aspects

With reference to the demographic data used in this paper, among the experimental statistics disseminated by Istat, the regional demographic forecasts of the population occupy a leading role. They depict the possible future trend of the population, both in terms of total number and in terms of structure by age and gender and demographic indicators. The information produced represents an important tool to support decisions concerning economic and social policies, such as those relating to pension, health, education and housing systems. The forecasts are periodically updated by reformulating the hypotheses underlying fertility, survival, international and internal migratory movements.

In September 2022, Istat released forecasts for the country's demographic future, updated to 2021, by region, gender and age group up to 2070.

On the other hand, with reference to the socio-economic variables taken into consideration, the survey on social interventions and services of individual or associated municipalities (conducted in collaboration with the Ministry of the Economy and Finance, the Regions and the autonomous provinces) collects information on the annual welfare policies managed at the local level. In particular, the available data are the number of users and the costs incurred for the social services managed by the Municipalities (individually or in association), by the Provinces, Regions and other territorial bodies which support or replace the Municipalities in this function.

Since 2011 Istat has disseminated data on users and expenditure on social welfare interventions by individual municipality, category of expenditure and type of user. The latest year for which data is available is 2020 (ISTAT, 2018; 2020; 2023). Due to the associative nature of the phenomenon, the disaggregation of data at the municipal level requires the introduction of an estimation component: the number of users, expenses and related percentage of each service, they include both the supplies made individually by the Municipalities, and the additional fees deriving from the Associations which they belong to. The data collected at the associative bodies are divided among the Municipalities that belong to them in

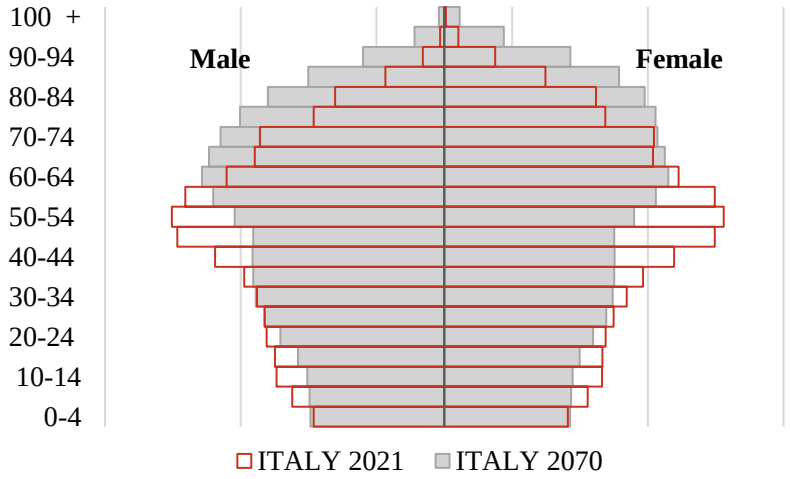
proportion to the reference population of the services.

2.2. Some elements of analysis: the demographic forecast

The new forecasts on the Italian's demographics, updated to 2021, confirm a potential crisis scenario.

The resident population is decreasing from 59.2 million as of 1st January 2021 to 57.9 million in 2030, to 54.2 million in 2050 up to 47.7 million in 2070 with a progressive reduction in the weight of the population 14- 50 years and a greater weight of the elderly population (Figure 1).

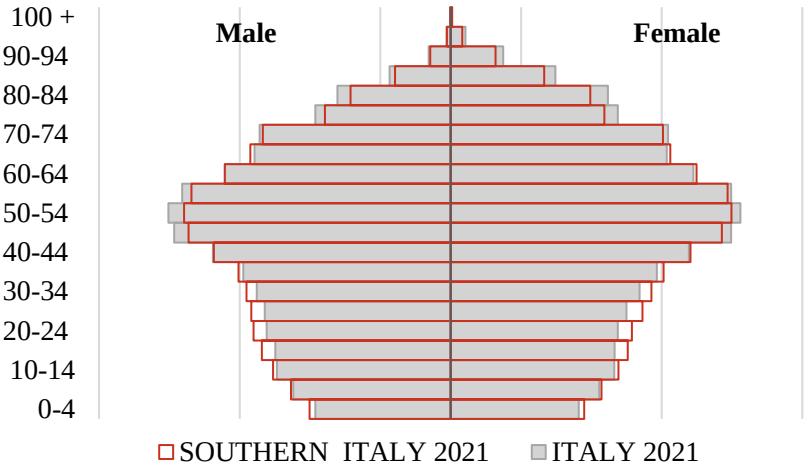
Figure 1 – *Population pyramid – Italy. Years 2021 e 2070.*



Elaborations on ISTAT data

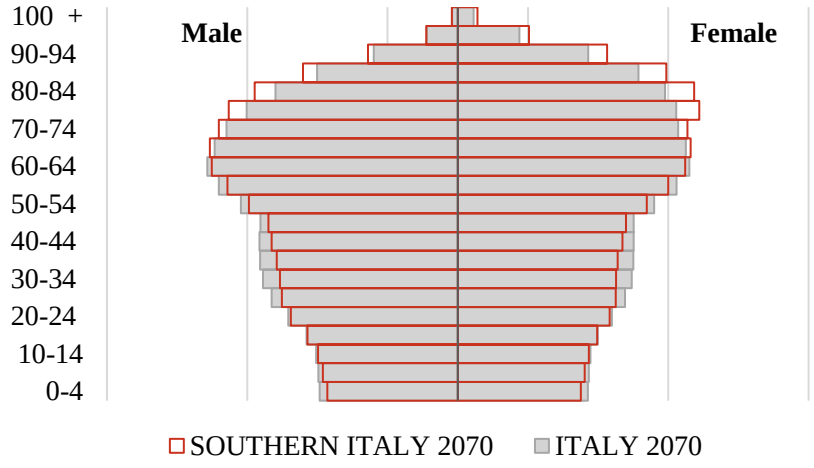
Such a decrease presents a strong heterogeneity among the macro-areas of the country, in particular the aging phenomenon that particularly affects Southern Italy. In fact, comparing the population pyramid of the South with the one of whole country in 2021 and 2070 (Figures 2 and 3), the former changes from being younger than the national average to significantly older in 2070.

Figure 2 – *Population pyramid – Italy and Southern Italy. Year 2021.*



Elaborations on ISTAT data

Figure 3 – *Population pyramid – Italy and Southern Italy. Year 2070.*

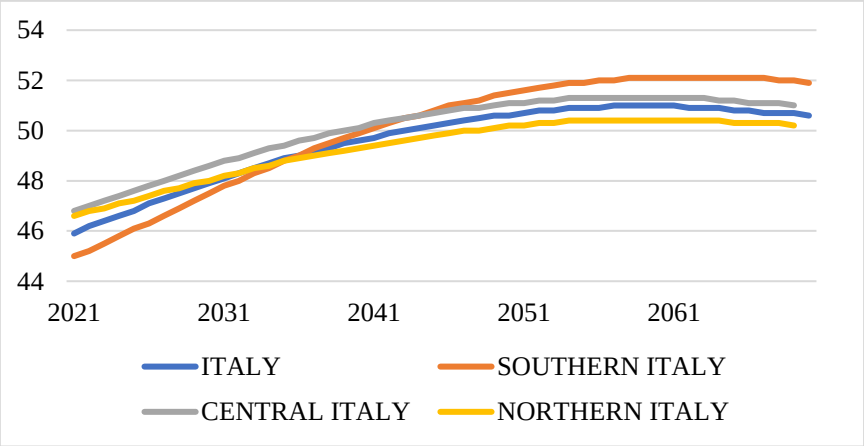


Elaborations on ISTAT data

This trend is confirmed by the historical series of the average age (Figure 4) and the incidence of the over 65 population (Figure 5). This also highlights the

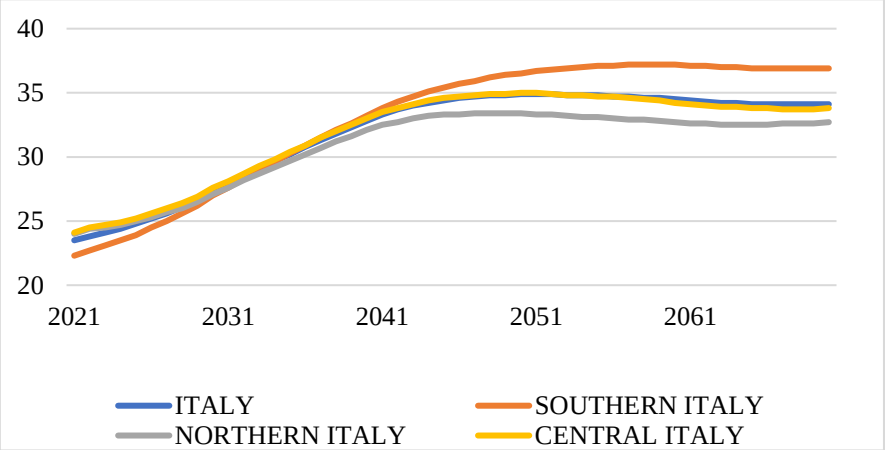
peculiarity of the South that, despite being the only younger macro-area with respect to the national context in 2021, sees the projection completely reversed in 2070, becoming the area with the greatest gap compared to the whole of Italy.

Figure 4 – *Forecast: mean age. Years 2021-2070. Italy and Southern Italy*



Elaborations on ISTAT data

Figure 5 – *Forecasts: Incidence of population over 65. Years 2021-2070, Italy and Southern Italy*



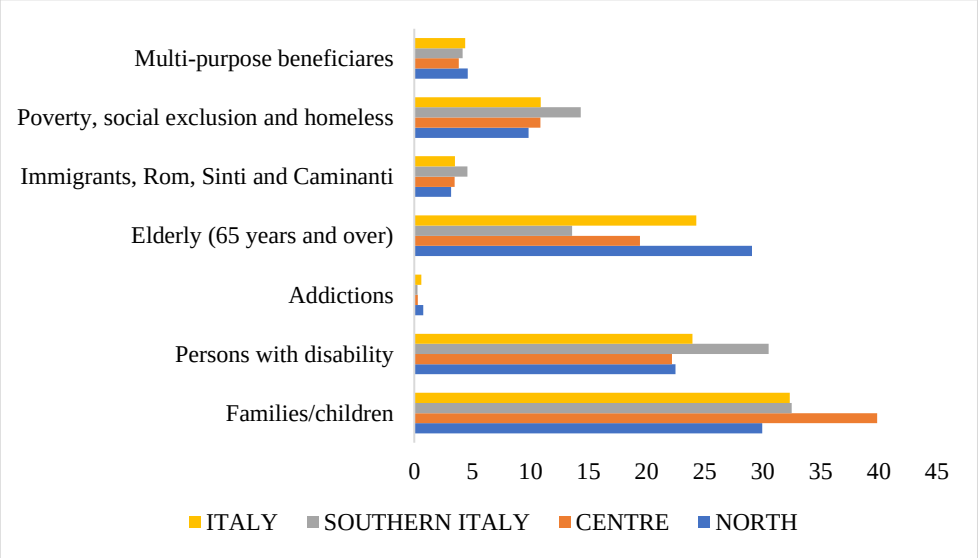
Elaborations on ISTAT data

2.3. Some elements of analysis: the Assistance expenditure

In 2020, 24.3% of the expenditure of municipalities for social welfare services was destined to elderly users (population over 65), with an incidence of over 29% in the North and about 13% in the South (Figure 6).

The supply of care services is characterized by very large territorial differences, in terms of both the type of service user and the services supplied (Table 1), and of the economic resources allocated to them (Table 2).

Figure 6 – *Assistance expenditure by category users – % Incidence - Year 2020*



Elaborations on ISTAT data

Table 1 – *Number of services provided for the elderly. Years 2015-2020.*

TERRITORY	SERVICES FOR ELDERLY (65 years and over)					
	2015	2016	2017	2018	2019	2020
NORTHERN ITALY	1.214.176	1.172.587	1.242.369	1.161.858	1.156.917	959.746
CENTRAL ITALY	370.182	319.708	418.604	380.144	368.418	249.059
SOUTHERN ITALY	334.773	321.353	336.341	292.536	285.615	219.779
ITALY	1.919.131	1.813.648	1.997.314	1.834.538	1.810.950	1.428.584

Elaborations on ISTAT data

Table 2 – *Expenditure on care for the elderly. Years 2015-2020.*

TERRITORY	EXPENDITURE ON CARE FOR THE ELDERLY (millions of euros)					
	2015	2016	2017	2018	2019	2020
NORTHERN ITALY	1.798.	1.769.	1.638.	1.711.	1.708	1.742
CENTRAL ITALY	423	375	418	423	405	363
SOUTHERN ITALY	268	284	289	289	255	251
ITALY	2.490	2.429	2.344	2.423	2.368	2.355

Elaborations on ISTAT data

Table 3 – *Services provided to the elderly on the elderly population. Percentage Incidences. Year 2020.*

CATEGORY OF SERVICE	NORTHERN ITALY	CENTRAL ITALY	SOUTHERN ITALY
Professional social work	5,3	3,0	1,7
Social home care	1,3	0,7	0,7
Aggregation and social centers	0,8	1,8	0,5
Recreational social cultural activities	0,8	0,5	0,6
Home care integrated with health services	0,7	0,3	0,2
Social transport	0,8	0,2	0,1
Contributions and additions to the fee for residential structures	0,7	0,4	0,1
Social and health vouchers	0,6	0,2	0,1
Residential structures	0,5	0,3	0,1
Distributing meals and / or home laundry	0,6	0,1	0,0
Day centers	0,2	0,3	0,3
Contributions for personal services	0,2	0,2	0,0
Remote assistance	0,3	0,1	0,1
Contributions to support the family income	0,2	0,2	0,0
Other activities of social inclusion	0,2	0,0	0,1
Other interventions of home care	0,2	0,0	0,0
Activities for the social inclusion of weak people	0,1	0,1	0,1
Proximity services (neighborly)	0,2	0,1	0,0
Contributions for transport	0,1	0,0	0,0
Contributions for housing	0,1	0,1	0,0

Elaborations on ISTAT data

(a) the colour of the cell identifies the presence of the supply of services in the territory, where the green colour represents a relatively present service and the red colour a relatively absent service, the yellow colour a value in line with the average presence

In 2020, in fact, the municipalities spent a total of around 2 billion euros on social welfare services for the elderly and over 70% of these resources were used by the northern municipalities which supplied around 1 million Euros of services.

An indicator of the territorial disparity that has already emerged in the use of services is given by the ratio between the number of services supplied and the reference population (over 65). In the South, despite the lower incidence for each type of service, practically no attention is paid to services that are not strictly "healthcare" (Table 3) such as recreational or proximity services.

3. Methodology

The expenditure of the municipalities for the assistance of the elderly can be classified in:

- Measurable determinants: Municipality's demographic weight, % Population over 65, Family structure typology, Change in the population, Individual well-being, Historical expenditure
- Non-measurable determinants: Political choices, Individual and collective behaviours, Access to services.

First, in order to be able to predict the level of the demand for services in terms of public expenditure, a regressive model was used as a forecasting tool (Figure 7).

Figure 7 – *Output of Regressive-Model*

Dependent Variable: Expenditure

R-Square	Coeff Var	Root MSE	Mean
0.8109	58.35978	59716950	102325526

Parameter estimates

Variable	Parameter estimates	Standard Error	T Value	Pr > |T|
Population	15.10776	1.79835	8.40	<.0001
Population 65 and over	3648845	346324	10.54	<.0001
Population growth rate	10676162	1065808	10.02	<.0001

However, this model was not able to measure the numerous factors such as individual behavior and policy choices, but helped highlighting the potentially significant variables to describe the relationship between socio-demographic aspects and expenditure, and the most appropriate explanatory methodologies to apply.

We therefore opted for the RUN RATE model or EXECUTION RATE usually

used to demonstrate key performance metrics, such as revenue or profit, for a year based on monthly or quarterly data. This method has also been widely used to create the tables of the supply and use of the national accounts, instead of constant technical coefficients.

The Revenue Execution Rate (also known as Sales Execution Rate), for example, forecasts future revenue over a longer period assuming that sales will remain constant. Of course, this simplistic approach assumes that nothing will change in the next period: churn, revenue expansion and growth rate changes, seasonal changes in consumer demands or changes in the market and political changes are all conveniently excluded. The run rate gives an extrapolation of current performance and assumes that current conditions will continue.

Using the RUN RATE model to predict the expenditure for social welfare services of the municipalities in the next decades, the expenditure in year *t* by a territorial area is estimated for each service *i* by applying to the expected population in year *t* three different hypotheses.

In the first hypothesis, defined as "inertial method", the macro-areas will not change their policy behaviour despite the changes in the world. The expenditure in year *t* by territorial area *R* ($Z_{t,R}$) is estimated for each service *i* by applying to the expected population in year *t* (x_{tR})

- the area's average expenditure per capita (R=territorial area)
- the average coefficient of use of the service in the area k_{iR}

$$Z_{t,R} = \sum_i w_{iR} k_{iR} x_{tR} \quad (1)$$

In the second hypothesis, defined as "equality method", the distributions will adapt to a national average behaviour and the expenditure in year *t* by territorial area *R* ($Z_{t,R}$) is estimated for each service *i* by applying to the expected population in year *t* (x_{tR})

- the average expenditure per capita ITALY (N=national)
- the average coefficient of use of the ITALY service k_{iN}

$$Z_{t,R} = \sum_i w_{iN} k_{iN} x_{tR} \quad (2)$$

The third hypothesis, defined as “best practices method”, the divisions use the spending model considered more efficient and the expenditure *R* ($Z_{t,R}$) is estimated with

- the average per capita expenditure of the NORTH (S=North, considered more efficient)
- the average coefficient of use of the NORTH service k_{iS}

$$Z_{t,R} = \sum_i w_{iS} k_{iS} x_{tR} \quad (3)$$

4. Results

The "inertial" forecast hypothesis highlights how, compared to 2020, Italy would need additional public expenditure, of around 900 million euros for 2050 and around 500 million euros for 2070.

Given that the spending behaviour remains constant in the three divisions (North, Center and South), in absolute values it would be the Northern one that needs around 500 million in 2050 and 300 million in 2070. Around 130 and 70 million more than in 2020 would be necessary in the South to cope with the increase in the elderly population expected in 2050 and 2070 (Table 4).

In relative terms, the three macro-areas would therefore require an increase in economic resources of 32.5% and 17.8% respectively for 2050 and 2070 for the North, 54.5% and 32.2% for the Center and 54.6% and 27.5% for the South.

Table 4 – *Expenditure forecast: first scenario*

TERRITORY	2020	2030	2040	2050	2060	2070
NORTHERN ITALY	1.742	1.933	2.267	2.308	2.156	2.052
CENTRAL ITALY	363	461	545	561	520	480
SOUTHERN ITALY	251	328	382	388	358	320
ITALY	2.355	2.723	3.194	3.257	3.034	2.853

Elaborations on ISTAT data

The forecast "equalization" hypothesis obviously does not envisage an increase in the overall requirement (Table 5) but a different requirement between the three macro-areas: if the North were aligned with the national average behaviour, it would need 11% and 21% less resources while the Center 89.5% and 62.3% more resources while the South should, compared to 2020, increase its resources allocated to social-welfare services for the elderly four times as much in 2050 and three times as much in 2070.

Table 5 – *Expenditure forecast: second scenario*

TERRITORY	2020	2030	2040	2050	2060	2070
NORTHERN ITALY	1.742	1.296	1.520	1.548	1.446	1.376
CENTRAL ITALY	363	566	669	688	637	589
SOUTHERN ITALY	251	895	1.041	1.059	976	874
ITALY	2.355	2.757	3.229	3.294	3.059	2.838

Elaborations on ISTAT data

The third and final forecasting model (that of the best practices), based on the hypothesis that the macro-areas must "replicate" the spending model of the most efficient macro-area (the North), obviously does not determine changes in incremental needs for the North compared to what expected with the inertial model, but presents a significant increase in the need for additional resources with for central Italy equal to 182.6% for the period 2050/2020 and 141.9% for the period 2070/2020.

With reference to the South, over 1 billion and 200 million more would be needed in 2050 to guarantee its population the same Northern standards and over 1 billion in 2070 (Table 6).

Table 6 – *Expenditure forecast: third scenario*

TERRITORY	2020	2030	2040	2050	2060	2070
NORTHERN ITALY	1.742	1.933	2.267	2.308	2.156	2.052
CENTRAL ITALY	363	844	997	1.026	951	878
SOUTHERN ITALY	251	1.336	1.552	1.580	1.456	1.303
ITALY	2.355	4.113	4.816	4.914	4.563	4.233

Elaborations on ISTAT data

5. Conclusions

The strong aging of the Italian population is redesigning social and economic structures, with consequences that are reflected in the field of production, consumption, the labor market and, above all, local welfare, with the obvious effects in reference to public spending, effects in which the forecast is undoubtedly extremely complex as it depends on various factors, such as: the quality of ageing, the efficiency of public spending, the choices of economic policy and the possibility of finding the necessary resources.

The different perspective in the supply of services and in the procurement of resources will have to be integrated with the new constitutional provision on differentiated autonomy which has expressly linked the recognition of autonomy to the LEP, i.e. the essential level of services: “The attribution of further forms and particular conditions of autonomy referred to in article 116, third paragraph, of the Constitution, relating to subjects or areas of subjects referable [...] to civil and social rights which must be guaranteed throughout the national territory, it is permitted subject to the determination of the relevant essential levels of performance (LEP)."

In order to be able to establish even just the trend of the forecast of the

necessary resources, it is important to understand the impact that choices such as those of historical, average or best practice expenditure can have on the forecast of demand and therefore subsequently on the consequent economic coverage.

With reference to this last aspect, the present study has illustrated how the combination of non-homogeneous aging methods for macro-areas, combined with the different attention and resources that the same areas have for assistance to the elderly population, calls for a profound reflection on the impressive consequences that the various choices of economic policy and welfare models could have in the near future.

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HOME ALONE, THE ONE-PERSON HOUSEHOLDS AT THE ITALIAN 2021 PERMANENT CENSUS. WHO ARE THEY? WHERE DO THEY LIVE?[1]

Angela Chieppa, Silvia Dardanelli, Simona Mastroluca

Abstract. From 2011 to 2021 in Italy households increase by 6.4% but they are getting smaller. The average number of components drops from 2.40 in 2011 (3.35 in 1971) to 2.24; census data show that people are more likely to live alone and the prevalence of one-person households is unprecedented historically. In 2021 they amount to 9,636,232 and represent 36.8 percent of total households compared to 31.2 percent ten years earlier.
The rise of one-person households reflects later marriage, longest stay in the family of origin, delayed childbearing, higher divorce rates, living-apart-together relationships, longer life spans, and, probably, also a growing desire for individual autonomy and independence. There are also socio-economic features that could lead to the choice of living alone as well as conditions or habits that are related to the place in which a person usually lives.
The aim of this work is twofold. The first one is to provide the main figures of the presence and amount of one-person households in Italy making use of the 2021 Permanent Census data; the territorial distribution and the evolution through the last census rounds are focused. Then, the objective of going deeper into the description of conditions and determinants of the phenomenon is pursued through a multidimensional analysis that takes into account demographic variables at individual and at regional/municipal level. The assumption is that the choice to stay alone is determined by individual characteristics but also by some general ones and local lifestyle habits. The census variables considered are sex, age, and citizenship while the surrounding conditions are expressed through some regional indicators such as the urbanization degree. The association between the one-person household status and the other variables considered is studied through an exploratory analysis, with unsupervised methods and then through a supervised model to statistically test specific effects in order to identify individual and territorial conditions that possibly determine the option of living alone.

1. Introduction

The reduction in household size is one of the most apparent findings of family change in recent decades. Between 1971 and 2021, the reference year of the last decennial Population Census, the average number of members in Italy fell from 3.35

[1] Although the paper is the result of joint work, paragraphs are attributed as follows: paragraphs 1 and 4 to Simona Mastroluca, paragraph 2 to Silvia Dardanelli, paragraphs 3, 3.1 and 3.2 to Angela Chieppa.

to 2.24. Thus, it is an increasingly smaller family affected by an aging population, declining birth rates and lively migration movements to and from abroad.

Changing lifestyles, times and ways of making a family. The difficulties of young people entering the labour market or simply opting to stay alone longer without starting a couple or parenting project, have led to a rise in one-person households that has never occurred in the history of our country. The growing trend of Living apart together (LAT), couples who are in an intimate relationship but choose to live separately for financial or personal reasons, contributes to the expansion of the phenomenon. The spread of living alone during later life is another outcome of the last census enumeration. The living arrangements of the elderly, and more specifically living alone, are the result of the preferences and resources people have, together with the constraints they face as they age (Reher and Requena 2018).

On December 31, 2021, in Italy one-person households represent 36.8 percent of total households and over the past 20 years they have grown by more than 20 percentage points: they were 24.9 percent in 2001.

Persons living alone are becoming increasingly common across Europe where, on average, the share is 35.9 percent (Istat, Rapporto Annuale 2022). Historical records show that this 'rise of living alone' started in early-industrialized countries over a century ago, accelerating around 1950. In countries such as Norway and Sweden, at the time, one-person households were rare, but today they account for nearly half of all households. (Esteban Ortiz-Ospina 2019). In Germany and France the share stands at 41.0%.

In Italy, since 2011, the number of male living alone increased relatively more steeply than female, even though in 2021 men living alone (46.3%) are still fewer than women (53.7%). The geography of households tells different stories in terms of the magnitude of the phenomenon but with one common denominator: the increase in one-person households is constant over time and spread across the country although with different intensities depending on the region of residence and the urbanization degree of the municipality.

2. Individual characteristics and territorial issues

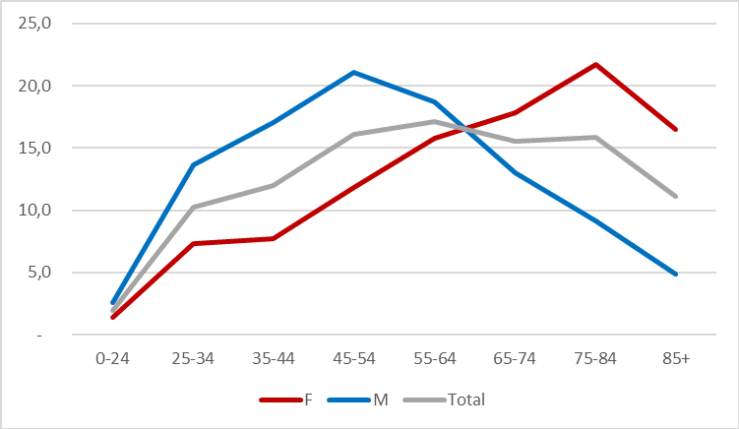
The condition of living alone varies greatly according to sex and depending on the age of individuals. One-person households are mostly composed of women and 42.6% are 65 years of age or older. Naturally, this is associated also with the gradual ageing of the population that results in a high proportion of elderly people compared to young people.

Analysing the living conditions of women and men, large differences are observed in the group of 65 years and over: among women this percentage rises to

56% and is almost double that of men for whom it stops at 27%. Women who form one-person households are mostly in the older age group, peaking between the ages of 75 and 84; significantly younger are men, with the highest incidence reaching in the age group 45-54 (Figure 1).

These different situations could be explained by the fact that in old age the condition of "home alone" is a female prerogative: women continue to live with their children at a younger age (also forming "Lone parent households") following a divorce and live alone when they become widowed or divorced and their grown-up children leave the family nucleus; the opposite is true for men, they live alone at a younger age when they are economically independent and even after a separation from partner do not live with their children. Moreover, men have a tendency to remarry as soon as possible when they are widowed.

Figure 1 – *One-person households by sex and age.*



Source: Permanent Census 2021.

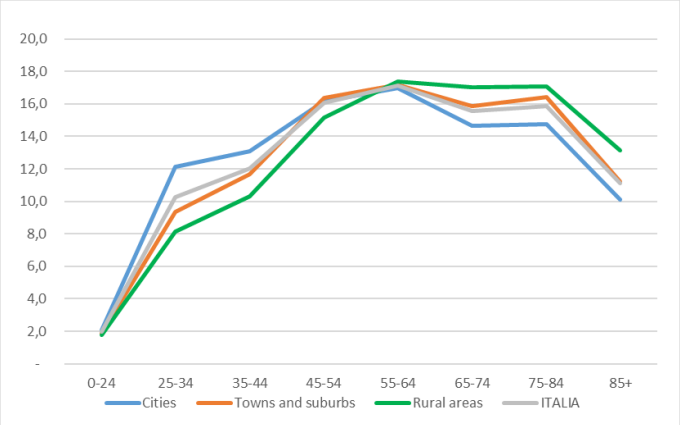
Among regions, age distribution of one-person households does not differ substantially; however older one-person households characterize mainly the South and the two major Islands while younger living alone prevail in the North and Center of Italy.

More than administrative territorial classification, an interesting dimension that could be helpful in analyse possible territorial peculiarities is the "degree of urbanization" of each Municipality (EUROSTAT, 2018). This variable classifies municipalities into three classes:

- cities - densely populated areas,
- towns and suburbs - intermediate density areas
- rural areas - thinly populated areas.

There are more apparent differences by degree of urbanization of municipalities: older individuals tent to live in rural areas rather than in cities, the reverse for youngest (Figure 2). In cities, in fact, there are greater possibilities for economic independence and relatively young people who move away from their family nucleus for work, for long-term training periods or for cultural choices of independence and autonomy, or even for the termination of previous marital ties, are more likely to live alone (Tomassini C., Vignola D., 2023).

Figure 2 – *One-person households by age and degree of urbanization.*

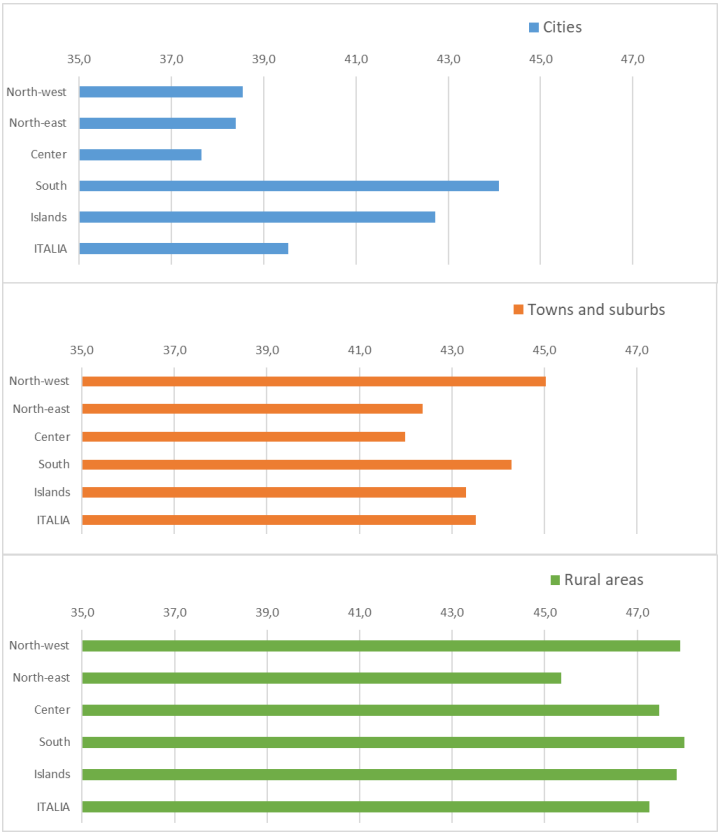


Source: Permanent Census 2021.

The distribution of the educational attainment of one-person households approximates that of the total resident population even if people living alone have a lesser share of lower and upper secondary education in favour of tertiary degrees. In 2021, the employment rate related to the population 15-64 is 60.6% while the share of employed one-person households out of the total one-person households in the same age group stands at 70.2%. 28.7% of employed living alone aged 15-64 have got a university degree compared with 24.5% observed for the total employed 15-64 years old.

Going into the details of the Italian regions, persons living alone show different settlement behaviour in cities, in towns and suburbs and in rural areas, presenting a certain variability among the different areas of the country especially between North and South (Figure 3). One-person households aged 65 and over tend to reside especially in rural areas and in town and suburbs rather than in cities, and this trend is particularly evident in the North and Central regions where persons living alone are mostly composed of young people who find in cities greater employment opportunities.

Figure 3 – *One-person households 65 years or over out of the total one-person households by regions and degree of urbanization.*



Source: Permanent Census 2021.

High shares of one-person households aged 65 and over out of the total one-person households characterizes especially the provinces of the South of Italy where the exodus of young people results in an increase of elderly people living alone. It is possible to hypothesise that the conspicuous presence of one-person households in urban contexts, made up mainly of people of working age, leads to the exodus of young people from rural areas of the South contributing to the generation of smaller and smaller households tending to be made up of elderly people who remain alone and therefore form single-person households not by choice.

3. Multidimensional analysis to derive patterns and determinants of living alone

To better describe conditions and determinants of the phenomenon, a multidimensional analysis is needed that takes into account simultaneously variables at individual and at regional/municipal level, while results of previous paragraph are mostly univariate or bivariate. The assumption is that the choice to stay alone is determined by individual characteristics as well as by some general ones and local lifestyle habits. In this paragraph the results of an analysis on some basic individual and territorial (local) classifications are described.

The dataset set up for this analysis is derived from the 2021 Italian Permanent Population Census database that contains one occurrence for each person usually resident in Italy; for the purpose of this study, only people aged 18 years old or more are taken into account. At individual level, the target variable is the dichotomic attribute (Yes/No) express the "Living Alone condition". At aggregate level, the response variable consists of the rate of people living alone on the total amount of resident people with same age. This rate could be read as the probability for an adult person to live alone and could be evaluated and studied at each possible level determined by each combination of the categories of other variables entering the analysis. The census individual variables considered are sex, age and citizenship; the territorial classifications used are the local administrative divisions (Municipalities, Provinces and Regions) and the urbanization degree.

The goal of the analysis is pursued through different techniques aimed at studying and verifying the main associations between the condition of living alone and the other variables. Furthermore, the analysis aimed at identifying which are the main groups of individuals with similar profiles that could significantly represent the patterns of people living alone. The first techniques used are unsupervised ones, that explore the complete association structure of data regardless of the specific impact on living alone probability. Then, a classification tree technique is performed where the target variable of Living Alone condition is used to "supervise" the classification algorithm to depict only the patterns relevant to explain the distribution of the living alone probability.

3.1. Significant dimensions and clusters detected on living alone population dataset: first results

A multiple correspondence analysis (MCA) is firstly used to undercover the associations between different variables and categories and detect more relevant dimensions that explain association structure in the analysed dataset (Greenacre et

al., 2006). Then the K-means clustering technique (Wu, 2012) is performed to partition the dataset in groups of similar cases. When using unsupervised methods, that undercover all multiple associations in the data, the original dataset (resident people with aged 18 or older) is filtered to extract only the entries related to individuals who live alone, in order to get significant results for the specific target population of this study.

The MCA computes the quantifications (dimensions) that explain most of the variability of the data. The discrimination measures of variables, representing the variance of quantified variables, are computed for each dimension. The first dimension resulting from MCA explains 30% of total variance in the data; the Age of individuals is the variable that shows the highest discrimination measure (0.62) of this dimension, followed by Sex and Citizenship (0.35 for both). The second dimension resulting explains 23% of total inertia; the Degree of Urbanization of the individual place of residence is the more discriminated variable along this dimension (0.43 of discrimination measure) together with Region of residence (0.37).

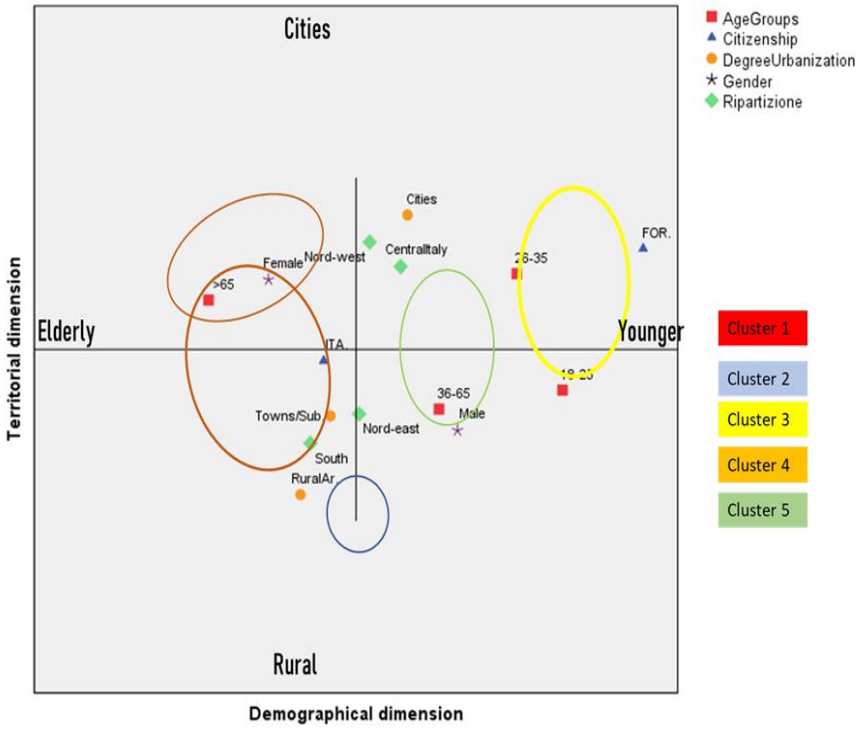
In the graphical representation (Figure 5), the horizontal axes is the first dimension resulting from the MCA, the one associated with the individual demographic characteristics. The vertical axes is the second dimension, associated with the territorial variables. The quarters above in the quadrant are related to cities and associated categories, while the opposite quarters, at the bottom, refer to rural areas. In the right half of the quadrant, the elderly population, mostly Italians, is plotted, while on the left there are the younger people. Foreigners are positioned on the left because of the high proportion of young foreigners.

The k –means clustering technique has been used to derive homogenous groups of cases. The resulting clusters are plotted in the same MCA scheme (Figure 4).

There are five clusters:

- Cluster 1: 22% of cases. 2,123,222 individuals. Modal values: women, large cities, north-west regions.
- Cluster 2: 9% of cases. Modal values: men, Italian, aged 65 years old or more, living in rural areas, north-east regions.
- Cluster 3: 17% of cases. Modal values: men, foreigners, adults, living in cities, concentrated in north-west and central Italy regions.
- Cluster 4: 30%. Modal values: women, older ages, intermediate density areas, south and major islands regions.
- Cluster 5: 22% of cases. Modal values: men, adults, intermediate density areas, south and north-west regions.

Figure 4– *Living along clusters by age, sex and territorial condition.*

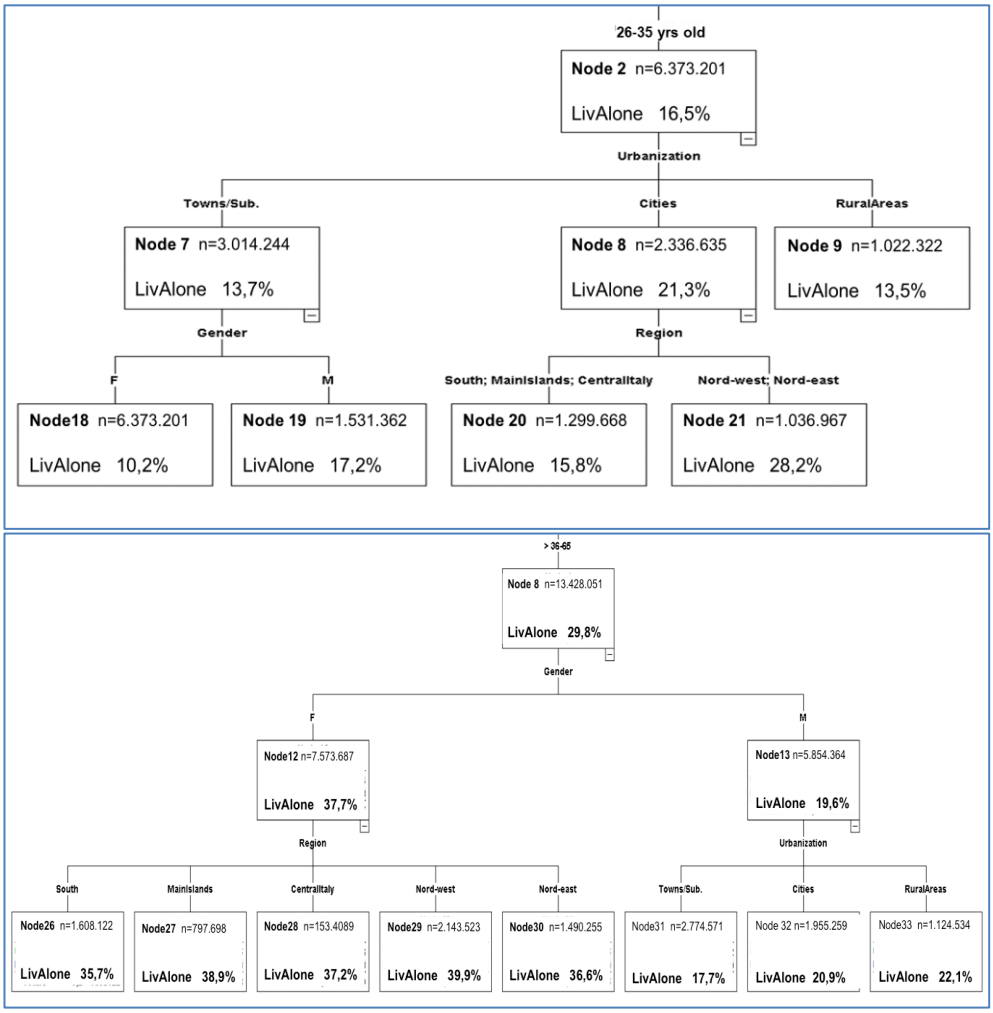


Source: Permanent Census 2021

3.2. Detecting groups and patterns by comparing living alone population versus not alone: classification tree technique.

Decision tree classifiers are supervised techniques, i.e. guided by a response variable whose values represent the target classes; the goal is to assign/label each unit in one of these classes, according to the values observed for the same unit on the other independent variables (classification features). Starting from a complete study dataset, the algorithm operates through successive partitioning steps (nodes) where the first step (root node) is the one in which all the elements are in the same set and are labeled with the modal value. At each successive step, a new partition is determined, based on rules expressed through the classification features, which produce subsets that maximize the association with the response variable. The algorithm used in the analysis presented below is CHAID (Ritschard, 2013), in which the measure of association used is the chi-square statistic.

Figure 5 – *Adult people living alone: comparison of decision tree results for people aged 26-35 years old and over 65 years old ones*



Extract from decision tree results, filtered by age
Source: Permanent Census 2021

Classification trees are predictive statistical models, but they are also very useful as a descriptive tool to identify the relationship between variables and to help determine how variables best merge to explain the outcome. The results of a classification tree (CHAID) applied to our analysis dataset are very useful for reading in a multidimensional way how the probabilities of living alone vary,

overcoming the univariate approach. The percentage of adult individuals living alone among all adult people residing in Italy (from now on: percentage of people living alone) is 19.60% but this value changes significantly according to some individual and territorial characteristics. The highest probability of being a person who lives alone is that relating to women 65 years old or over (37.70%), while the lowest one is that of the 18-25 age group (6.0%). Territorial breakdowns, representing specific socio-economic conditions and possibly cultural ones, show that the percentage of people living alone is higher in cities and that the probability for a young adult (26-35) to live alone is almost the half that in the North West (11.30% vs 20.20%). The tree model does not succeed in identifying rules to accurately predict the living alone condition, because all subsets detectable with the independent variables considered in this experimentation show a higher percentage of people not alone (always predicting "living not alone"). Nevertheless, the results are very useful in detecting different combinations of individual and territorial determinants associated with the choice of living alone. In Figure 5 there is an insight into the results of the classification tree, filtered for people aged 26-35 compared with people aged 65 years old or more.

For the ages between 26 and 35, the tree algorithm identifies 5 possible profiles, determined in the first level by the degree of urbanization of the territory in which they live. Urbanized areas show a significantly higher percentage of people living alone (21.3% against approximately 13% in all areas with different degrees of urbanization):

- in towns/suburbs sex significantly affects the probability of living alone: 17.2% for men against 10.2% for women.
- in highly urbanized cities/areas, the region of origin is the most determining factor: 15.8% probability of living alone, for the age group considered, in the South and Islands against 28.2% in the regions of Northern Italy.

For people over 65, the results show that what firstly determine different patterns is the sex: women have a percentage of 37.7% against 19.2 for men. Beside this general determinant, affecting the entire population of people of this age group, territorial (cultural/socio-economic) determinants enter to definie final choice:

- for women, the territorial variable that determine different subgroups is the region in which one lives; for women from the North-West the probability of living alone is about 39%, while in the South is 35.7%.
- for men, on the other hand, it is the degree of urbanization that distinguishes the profiles with the lowest probability: medium towns and suburbs are the areas with lowest probability for an old men to live alone, againtst more than 20% for who live in cities or rural areas.

4. Conclusions

The results of the first analysis on one-person households, based on 2021 Population Census data, clearly show different patterns of individual and territorial determinants. The basic demographic variables and the territorial ones appear to be strongly associated with living conditions choice. Unsupervised techniques help in confirming that urbanization degree is more relevant than regions, while age is the individual attribute that clearly identifies specific patterns and subgroups. Supervised classification tree is very useful in identifying these patterns: for younger people the surrounding urbanization conditions determine the choice of living alone, regardless sex or regions; on the contrary, for older people, sex is the stronger determinant of decision. Then, for men, probably also for socio-economic reasons, the degree of urbanization of the municipality has the greatest influence, while for women, by tradition and cultural background, the most relevant factor seems to be the region of residence. The stages of producing, validating and disseminating estimates for additional variables included in the survey design of the 2021 edition of the Permanent Population Census are underway. It will then be possible to use more data and variables to further characterize those who, out of necessity or choice, decide not to share housing with other people by pursuing a life project of independence and sometimes loneliness. Moreover, an evaluation of available administrative sources, such as, for example, GDP per capita and average housing cost, is underway, to improve the description of the surrounding determinants at municipal level. In addition, 2021 census data on other types of households and family nucleus will also be disseminated by March 2024, which, together with information on one-person households, will help to more precisely define the profile of Italian households and their evolution over the twenty-first century.

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EFFICIENCY OF SURVEYORS' TRAINING: IN-PERSON MEETINGS VERSUS DISTANCE LEARNING[1]

Nunzia Balì, Gabriella Fazzi, Francesca Rossetti

Abstract. Since 2010 the Italian National Institute of Statistics (Istat) has experimented with a blended training model, for the Labor Force survey, with face-to-face training modules and online modules for specific topics. This approach was adopted structurally in 2017 with the pilot survey of the Permanent Population Census. The technological, organizational and methodological framework constructed subsequently made it possible to react promptly to the restrictions imposed by the 2020 lockdown, quickly replacing in-person teaching with live training events. The return to "normality" has led to some requests to return to the pre-2020 training mode of face-to-face classroom meetings.

The aims of the paper are, first, to evaluate the effectiveness and efficiency of resuming the previous training model and, secondly, to identify different groups of respondents who could benefit from each approach. We analyzed two different training experiences: the first in relation to the Survey on Aspects of Daily Life (ADL) was entirely online; the second concerned two editions of the Survey on Income and Living Conditions (EU-SILC), with the 2021 edition entirely online and the 2022 edition entirely in presence.

For the EU-SILC, we compared the results of the final learning tests with those obtained the previous year when the training was conducted exclusively online. We have applied a statistical analysis based on a logistic model to evaluate the effect of the different training models on the performance.

In 2023, for both surveys considered, we administered a questionnaire to capture the learners' views and conducted a non-participant observation to assess the quality of the interaction between the teachers and learners and the level of classroom attention and engagement. We adopted a cluster analysis to identify different groups of respondents who could benefit from each approach.

The results show that the face-to-face training model is more effective than the online model, with a better learning experience for experienced surveyors. The interviewers who attended both online and face-to-face sessions preferred the latter, at least for online sessions organized as long live sessions. They considered that any remote training should be of a shorter duration and include more discussion elements and strategies to reduce the distance, using tools that allow greater connectivity, such as icebreakers.

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[1] Nunzia Balì is the author of paragraphs 1, 1.1, 1.2 and 4; Gabriella Fazzi is the author of paragraphs 2 and 3.1; Francesca Rossetti is the author of paragraph: 3.2. The authors thank the reviewers for their valuable insights and constructive comments, that helped to improve the paper.

1. Introduction

During the Covid-19 pandemic, the training activities of the network of surveyors were carried out exclusively at a distance, making it possible to continue the training. Once the emergency phase was over, the online training experience highlighted positive aspects such as economic savings for Istat and a better balance between work and private life for the trainers and trainees. The number of sessions carried out to train and support the different interviewers responsible for the data collection phase increased. However, in-person training undoubtedly has its advantages and strengths: a direct interaction, experiential learning, a personalization of the content and the creation of relationships, as well as an increased motivation and commitment, thereby enriching the classroom training experience (Rotondi, 2000).

We used the start-up and training phases of two household surveys with different mixed mode data collection techniques and different interviewer networks. In particular, we considered the Survey on Aspects of Daily Life (ADL), characterized by a Computer Assisted Web Interviewing Computer Assisted Personal Interviewing (CAWI-CAPI) technique and conducted by means of a public interviewer network, and the EU-SILC survey, characterized by a Computer Assisted Telephone Interviewing - Computer Assisted Personal Interviewing (CATI-CAPI) technique and conducted by means of a private interviewer network. On both occasions, we used a range of tools to collect the data and information (satisfaction questionnaires, non-participant observation forms and learning evaluation tests) capable of providing answers to meet our objectives.

In the design phase of the training course, we devised an evaluation plan for the methods used to verify the quality of the training activities. The training model for both surveys involved theoretical[2] phases alternated with technical-practical[3] phases, defining a schedule that balanced theoretical and practical aspects. It included general issues (methodology, administration strategies and an interpretation of the questions and technical aspects more closely linked to the use of electronic instruments) and specific issues associated with the typical features of the two surveys (Balì and Federici, 2014).

[2] The theoretical training was aimed at training the interviewers on the content, objectives, methodology, regulatory aspects, questionnaire structure, behavioral rules to adopt with the respondent during the questionnaire administration and strategies to motivate respondents reluctant to cooperate.

[3] The technical and practical training was conducted for the private network by the company appointed by Istat in tandem with Istat personnel. It was aimed at illustrating the software's functioning in the management of the electronic questionnaire and the contact management system. This training was also designed to train the interviewers in the administration of the questionnaire through a simulation of an interview.

The paper is organized as follows: sections 1.1 and 1.2 describe the data collected from the ADL Surveys and EU-SILC surveys, with a description of the training activities; section 2 presents the method of the training evaluations, with a focus on the post-assessment tests and questionnaire evaluation design; and section 3 shows the analysis of the post-assessment and questionnaire results.

1.1. The Survey on Aspects of Daily Life (ADL) and Training Activity

The first edition of the ADL survey dates back to 1993 (Istat, 2023). Since then, it has undergone considerable methodological changes over the years, which have also affected the training of the municipal network. For several years, the training plan adopted saw the application of a traditional cascade type of training model from the center to the territory (with central Istat staff training the colleagues of the territorial offices, who in turn trained the municipal managers and then the interviewers), Subsequently, in 2017, a mixed training model was introduced, with a combination of self-study accompanied by in-person training elements, a model which was used until 2019.

In 2020 and 2021, with the health emergency resulting from the Covid-19 pandemic, the training was fully delivered online and the virtual classroom replaced in-person classroom training. This modality was also adopted in 2022 following an internal reorganization of the institute, which changed the organizational structure of the territorial offices.

We aimed to take into account the training experiences realized with the permanent censuses (Agriculture, Non-Profit Population and Enterprises, etc.) (Balì et al., 2023) and the awareness of the importance of the training element in terms of the quality of the information collected. Accordingly, we set ourselves the objective of reviewing the training strategies for the AVQ survey in 2023, envisaging the integration of several training modes aimed at fostering moments of discussion on specific activities (Balì, 2019).

A new training framework was thus designed for the actors involved in the municipal network. The main steps, entirely online, were:

- a consultation, before the launch of the survey, with a small group of municipal managers belonging to large and small municipalities in the north, center and south, aimed at gathering valuable suggestions to fine-tune the entire training system and to set in motion a training circularity system to optimize the whole survey process;
- short virtual meetings organized from 8 February to 17 March 2023 managed centrally with about 1,000 municipal officers divided into 5 groups, focusing on the tasks necessary to launch, manage, train and monitor the survey;

- self-study online modules and self-study FAD training for interviewers with a pass mark of 8 or higher on a final test.

Table 1 presents a summary table of the training activity numbers.

Table 1 – *ADL participants in the training activity. Year 2023.*

	N
municipal managers participating in consultations	10
municipal officers participating in online meetings	1,001
interviewers involved in the self-study online modules	1,884

Source: our elaboration of data from 2023 attendance in the training activities.

1.2. The Survey on Income and Living Conditions (EU-SILC) and the Training Activity

Since 2004, Italy has participated in the EU-SILC (Statistics on Income and Living Conditions) statistical system with a complex survey on income and living conditions. The data collection has been entrusted to a survey network managed by a private company. Training for this survey was always centrally managed by Istat and delivered in a face-to-face mode until 2020. Since 2023, there has been a return to in-presence training.

In 2023, experienced interviewers, involved in the 2022 edition, and new interviewers participated in the in-presence training. The course took place from 20th to 24th February 2023 with two training sessions: the first was delivered to 124 experienced CAPI or CATI interviewers; the second to 84 new CAPI or CATI interviewers.

2. Methods for the training evaluation

The primary goal of this research was to compare and evaluate the efficiency and effectiveness of online and in-presence training methods (Nagy and Duma, 2023). We used the post-assessment test results after the 2022 and 2023 EU-SILC training as proxy indicators of efficiency and effectiveness. The test was designed to evaluate learning outcomes and included a varying number of questions, ranging from 10 to 15, pertaining to the survey's objectives and aims, the content of the questionnaire and the most relevant defining aspects.

The secondary goal was to identify specific groups of people who could benefit more significantly from each method. We used data collected by means of a course

evaluation questionnaire completed at the end of the ADL 2023 and EU-SILC 2023 training to capture the trainees' views.

At the end of each meeting the participants were required to evaluate whether the training session had been helpful to them. The evaluation questionnaire included indicators of course satisfaction related to the following dimensions: the training organization, the training duration, the didactic management, the clarity of the content, the completeness of the issues presented, the utility of the course for the job and overall satisfaction. Each indicator was operationally defined according to a 5-point scale (from "not satisfied at all" to "completely satisfied").

ADL municipal officers who had attended an in-person training in the past, and EU-SILC expert interviewers who had attended the online training in 2022 and the in-person training in 2023 were asked for a comparative evaluation of the virtual classroom vs. the in-person training experience. The evaluation of the training modality (online or in-presence) was operationally defined according to a 7-position scale, where the respondent was asked to assess whether, on the different dimensions proposed, they considered online or face-to-face training more effective. The dimensions analyzed were: clarity of the content; interactions with the instructors; interactions with the other participants (peers); ease of making a contribution; balance with other commitments; ability to stay focused; and opportunity to participate in workshops.

3. Results

3.1. Analysis of the post-assessment results

For the ADL post-assessment the required pass mark for the test was 8 out of 10, with each participant being able to try as many times as necessary to pass the test. The average score obtained by the municipal officers (about 1,000 respondents) and interviewers (about 1,200 respondents) was 8.8; 57% of the municipal officers obtained a vote higher than 8 after one attempt compared with 45% of the interviewer group. In the municipal officer group only 14% tried four times or more compared with 22% of the interviewer group.

For the EU-SILC survey the required pass mark for the test was 7 out of 10. For this survey we could compare data from two different years: 2022, when the live training was completely online, and 2023, when we returned to in-presence training.

The 2022 post-assessment result, measured as the average score obtained by 241 interviewers, was 6.9. In 2023 this increased to 8.5. It is important to assess whether this increase was due to the return to the face-to-face modality and whether the effect of the experience gained by the interviewers or the different composition of the

groups should be taken into account. In order to analyze the impact of the different training models adopted with respect to the EU-SILC in 2022 and 2023, the interviewers' performances in the final learning test were used.

The data used to achieve this objective were collected during the training activities, selecting all the learners who would be interviewers in the survey and had completed the training cycle: 241 in 2022 and 282 in 2023. The performance indicator used was the percentage of correct answers in the final test; the indicator takes a value of 1 when the number of correct answers exceeds 70.0%, and 0 when it falls below this threshold. The test, different for each training session, included a varying number of questions, ranging from 10 to 15. It is important to remember that the minimum pass score for this test is 60.0%. The mean value of the indicator recorded was 68.9%. To assess the likelihood of the interviewers achieving a positive outcome at the end of the training course, a logistic model was constructed. In the model the dependent variable used is the performance indicator. Table 2 reports the explanatory variables used in the model.

Table 2 – *Explanatory variables and mode encoding applied. EU-SILC trainees. Years 2022, 2023.*

Explanatory variables	Code
Learning model	0=online (year 2022); 1= in-presence (year 2023)
Geographical area	1=North-west; 2=North-east; 3= Centre; 4= South
Sex	0=Male; 1=Female
Interviewer's experience	0=no experience; 1= with experience
Age	1=under 35 years; 2=35-44 years; 3=45-54 years; 4=over 54 years
Data collection technique	0= CATI; 1=CAPI
Educational level	0=secondary school certificate; 1= tertiary certificate

Source: our elaboration of data from 2022 and 2023 EU-SILC post-assessment tests.

Table 3 reports the Chi-square statistics with the associated p-values (the variables without significance in the model are highlighted) and the odds ratio, which represents the coefficients in the logistic model for the explanatory variables. In particular, the significant variables are the year of the survey, which represents the different training models, and the interviewer's experience. Comparable outcomes were achieved when utilizing indicator variables for each mode among the explanatory variables.

Table 3 – *Explanatory variables, Chi-square statistics with p-value associated. EU-SILC trainees. Years 2022, 2023.*

Explanatory variables	odds ratio	Pr>Chi-Sq
Learning model	6.1	<.0001
Geographical area	1.0	0.8793
Sex	1.0	0.9164
Interviewer's experience	1.9	0.0054
Age	1.1	0.6478
Data collection technique	<0.0	0.9878
Educational level	0.8	0.4499

Source: our elaboration of data from 2022 and 2023 EU-SILC post-assessment tests.

The model shows that the propensity to have a good result in the training course is six times greater with the face-to-face training model applied in 2023 compared with the online model applied in 2022[4]. Experience is the only interviewer characteristic with any significance. The odds ratio value suggests that the propensity to have a good result for the interviewers with experience is double that of the interviewers without any experience.

3.2. The Evaluation Questionnaire Results

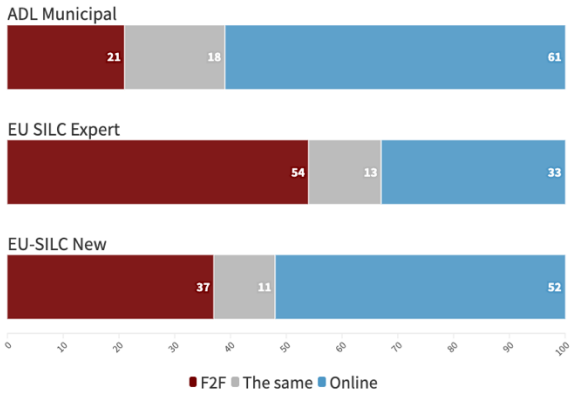
The ADL evaluation questionnaire was completed by 240 out of 1,001 municipal officers, with a response rate of 24.0%. The response rate for the EU-SILC 2023 questionnaire was higher, thanks to the reminders issued by the external company, namely 47.6% for the group of expert interviewers (59 out of 124) and 85.7% for the group of new interviewers (72 out of 84).

Figure 1 presents the preferences for the online or face-to-face modality among the ADL and EU-SILC trainees. More than 60% of the ADL municipal officer group answered that they would prefer to participate in the training online, with only one out of five (20%) indicating that they would like to return to in-presence training. The role of these respondents, working at the statistical offices of the municipalities, can perhaps explain this result. They are involved in several activities and this training can be better balanced with other work duties if it is online, without the time and expense required for travelling.

[4] The EU-SILC survey is managed by a private company, and in 2022 the contract with the company responsible for the data collection process commenced, which involved recruiting and organizing the data collection network. This was a particularly challenging undertaking in the context of the pandemic. Undoubtedly, an established organizational structure greatly assisted this activity in 2023, resulting in improved training outcomes.

It is interesting to compare this response with the answer to the same question given by the EU-SILC interviewers. More than half of the experts, who had undertaken the training online in the previous year, did not want to return to the previous online method. On the other hand, half of the new interviewers would prefer online training. If we review the schedule and organization of the online training during 2022, we can better understand the response of the expert interviewers. In 2022 the online training had been organized with live events, with trainers speaking in a virtual classroom during a 3-day event, 6 hours a day. The interviewers who experienced the 2022 online training remarked that when the online training consisted simply of the online transposition of a classic frontal lesson, the "original" frontal lesson was preferred.

Figure 1 – *Preferences for the online or F2F (face-to-face) modality among the ADL and EU-SILC trainees. Year 2023 (Percentage values).*



Source: our elaboration of data from 2023 ADL and EU-SILC evaluation questionnaires.

To support this interpretation, we can rely on the answers given on the scale proposed to compare the online and in-presence training with respect to the different dimensions. We have classified the answers on the 7-point scale as a dichotomy (better online vs better in-presence), excluding the middle position (indifferent). We have thereby constructed an index, being a rate of "online propensity", such that

$$online\ propensity = N \text{ better online}/\ (\text{N } better\ online + \text{N } better\ in\ presence)$$

This index varies from 0 (when everybody prefers the in-presence training) to 1 (when everybody prefers the online training). If the value is equal to 0.5, it means that the two methods are evaluated as equal with respect to that aspect.

As expected, the values are higher for the ADL group on each dimension, especially for the "balance with other commitments". The municipal officers also recognized the ability to stay focused, as they participated in short online events of a maximum of 4 hours, partly dedicated to practical training. The interaction is obviously the component that we sacrifice when we deliver the training online, thereby reducing the possibility of speaking with the instructors and the other participants.

Peer interaction is the critical aspect of the online training, evaluated with a 0.1 rating by the EU-SILC expert interviewers. In an online class informal interactions with colleagues are absent, including all the practical tips, information and opportunities for collaboration that a "shared coffee break" can allow.

Table 4 - *Online propensity index, ADL and EU-SILC trainees. Year 2023 (scale of 0 to 1).*

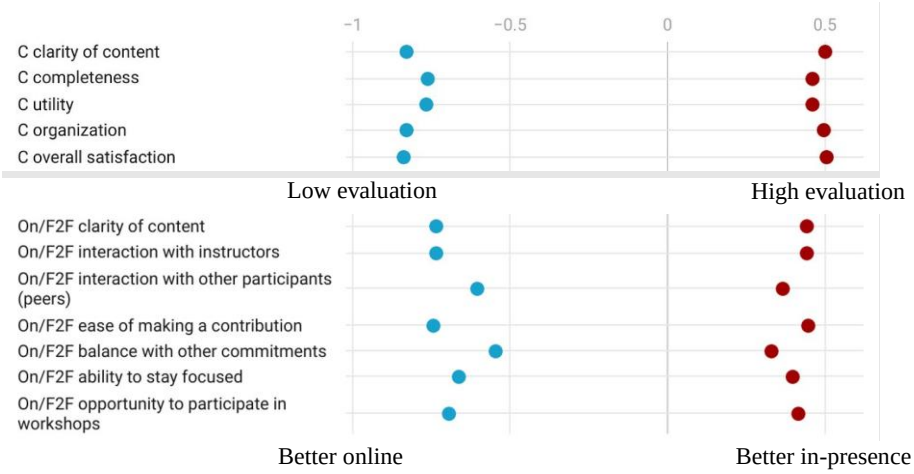
	ADL	EU-SILC
clarity of the content	0.6	0.3
interactions with the instructors	0.3	0.2
interactions with the other participants (peers)	0.3	0.1
ease of making a contribution	0.4	0.2
balance with other commitments	0.8	0.4
ability to stay focused	0.6	0.3
opportunity to participate in workshops	0.6	0.3

Source: our elaboration of data from 2023 ADL and EU-SILC evaluation questionnaires.

Finally, we performed a cluster analysis on the EU-SILC questionnaire results to reveal any specific group that could be better suited to receiving online training. The cluster analysis was conducted using k-means clustering (Seol, 2022) on Jamovi software (Navarro and Foxcroft, 2019).

We included in the analysis the variables related to course satisfaction (cfr. § 2) with respect to the clarity of the content, completeness of the issues presented, utility of the course for the job, organization and overall satisfaction. We also included the indicator of preference for the online or in-presence training modality for the several dimensions described in § 2 and reported in Table 4.

Figure 2 – *Centroids of the clusters, EU-SILC trainees. Year 2023.*



Source: our elaboration of data from 2023 ADL and EU-SILC evaluation questionnaires.

Figure 2 reports the centroids of the two clusters [5]. It is possible to characterize two groups. The first is composed of the experts (the centroids of the cluster for the "experience" are -0.180 for group 1 and 0.109 for group 2), who gave a better evaluation with respect to the 2023 training and declared a preference for the face-to-face modality. The second group, composed of the new interviewers without any previous experience of this training, gave a more critical evaluation of the course attended, demonstrating a greater propensity for the online modules. The results indicate that the evaluation of the present course could have influenced the preference for the online or in-presence modality.

4. Conclusions

The results of the data analysis open up a reflection on a number of relevant issues in relation to how to manage 'knowledge' which has to be transferred to interviewers and managers of a public and private survey network and how to reinterpret training after the pandemic.

The results of the logistic model applied to the EU-SILC interviewer post-assessment show that the propensity to score well in the training course is six times higher for the face-to-face training model than for the online model, and twice as high for the experienced interviewers as for the inexperienced interviewers.

[5] The results are based on 77 valid answers, the variables being standardized.

As highlighted by the evaluation questionnaire results, the expert interviewers who attended both online and in-presence sessions, preferred the latter, at least when the online sessions were organized as long live sessions. They considered that remote training should be of a shorter duration and include more discussion elements and strategies to reduce the distance, using tools that allow a greater connectivity, such as icebreakers. Microlearning or 'small bites' is regarded as more effective (Hug, 2005), i.e., training designed in many small learning units. In this way, there is no risk of spending too much time in front of a device screen, thereby reducing the possibility of fatigue and distraction but at the same time favoring the possibility of taking notes and acquiring the correct information.

According to the Hug (2005), blended models, which combine the learning phase online (with live events and self-paced learning modules designed for distance learning) should be considered, taking into account the survey technique, the survey network - public or private - and the degree of experience of the participants to be trained.

In-presence training itself requires a shift towards more streamlined training, combining and integrating theoretical and practical knowledge using physical and digital spaces. In-person meetings should be organized to facilitate the interaction between peers and trainers (Eom, 2016).

A new phase of the training study of the Census Population Network is under way, with two separate groups receiving fully online training and one group receiving face-to-face training. This further experience will make it possible to assess the effectiveness of training courses which differ in terms of content, training method, survey characteristics and type of participant to be trained.

We maintain that different learning models should be designed in an adaptive mode to meet the needs of different learners and networks, municipal or private, expert or new, with different roles, interviewers or managers. The goal should be not only that of transmitting specific training 'content' but also, above all, of constructing the role of operator of official statistics.

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MIGRANTS' HEALTH IN ITALY: DO THE UNION STATUS AND THE PARTNER'S NATIONALITY MATTER?

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Abstract. Being in a romantic union is consistently found to be associated with better health, both because of selection mechanisms and due to virtuous (i.e., healthy) behaviours of coupled individuals. However, the relationship between union status and health status has received considerably less attention among migrant populations, and, to the best of our knowledge, it has never been analysed in Italy. This study aims to fill this gap in the literature, moving one step further: we also explore whether having a partner of migrant or native origin influences migrants' health. Results suggest that migrants in a romantic union have lower risks of experiencing mental health issues, and female migrants fare better in terms of self-rated health and mental health when their partner is of native origin rather than a migrant themselves.

1. Introduction

The migration phenomenon in Italy has undergone a well-documented transformation over a history spanning more than forty years (Strozza, 2018): during the '90s it was marked by the presence of pioneering male workers, while over the past two decades, these initial flows were succeeded by family reunifications or the establishment of new families in the host country. As a result, migrants today represent an established and settled population in Italy, numerically relevant, and which contribute to the increasing family diversity. In a similar context, a deep understanding of migrants' life conditions is crucial. In this paper, we focus on migrants' health in Italy, analysing the role played by their union status and by the nationality of their partner – for those who are partnered – in shaping their health.

The protective effect of marriage on individuals' health and mortality has been widely studied on the overall population (e.g., Rendall *et al.*, 2011), while studies on migrants are limited (e.g., Maxwell and Harding, 1998). Generally speaking, the literature shows a positive relationship between being married and having good health. However, despite mixed unions have become increasingly popular over the past years (Lanzieri, 2012), the relationship between the partner's origin (or nationality) and individual health status has been surprisingly disregarded. Some studies demonstrated an association between being in a union with a native and improved economic aspect, indicating that such unions offer migrants some type of

gain (e.g., Elwert and Tegunimataka, 2016). Other studies considered non-economic aspects such as life satisfaction (e.g., Chang, 2016; Potarca and Bernardi, 2021). Only few studies addressed the relationship between having a native vs. a migrant partner and mental health (Eibich and Liu, 2021; Milewski and Gawron, 2019), and we will discuss them in the literature review.

In Italy, literature about migrants' health is limited and recent due to the nature of the migration history of the country, which is relatively recent with respect to all other European countries. The few studies available analyse migrants' mortality (Alicandro *et al.*, 2020; Trappolini *et al.*, 2021), migrants' use of health care services (Devillanova and Frattini, 2016; Trappolini *et al.*, 2020), migrants' health (Loi and Hale, 2019) and gender disparities in health (Trappolini and Giudici, 2021). To the best of our knowledge, differences in migrants' health by marital status in Italy have never been studied, especially focussing on the partner's migration background.

The aim of this study is twofold: first, it analyses whether being in a stable union has a positive effect on migrants' health; second, it explores whether the partner's nationality plays a role in determining individuals' health. In this regard, we refer to exogamous unions to identify unions between an Italian and a foreign citizen, and to endogamous union to identify unions between two foreign citizens.

2. Literature review: The link between union status and health

Demographic literature showed the protective effect of marriage – or, more generally, being in a stable union – on individuals' health and mortality (Carr and Springer 2010; Rendall *et al.*, 2011).

In the literature, there are different mechanisms to explain such a pattern. First, the better health or lower mortality of married individuals is a consequence of the selection of healthy people into marriage (Waldron *et al.*, 1996). The second one focuses on economic resources. Marriage provides economic benefits, including economies of scale and increased earning potential for men, leading to improved living conditions and better access to quality healthcare (Killewald, 2013). Additionally, marriage plays a role in social control, as it is associated with norms discouraging health-risk behaviours like smoking and drug use. When individuals enter marriage, they are more likely to adhere to these norms due to the influence of their spouse and a sense of responsibility towards their family (Fleming *et al.*, 2010). Furthermore, the marital relationship offers significant social support and emotional affection, which can alleviate feelings of loneliness, depression, and improve mental well-being (Peters and Liefbroer, 1997).

Although this topic has been extensively analysed on the overall population, there is a scarcity of studies focusing on migrant populations. The study by Maxwell and Harding (1998) suggests that marital status is a key determinant for migrants'

mortality as well: unmarried individuals have a higher mortality than married ones. In another study, Koball *et al.* (2010), analysing the African Americans, show that the links between marriage and health for African Americans vary depending on characteristics, beyond race, of the individual. In a different setting, female marriage migrants in Southeast Asia were found to experience worse health than the native population in their destination countries (for a review, see Yu *et al.* 2019).

Other few researches examine differences in life satisfaction (Chang, 2016; Gawron and Carol, 2022) and mental health (Eibich and Liu, 2021; Milewski and Gawron, 2019) between migrants in endogamous or exogamous unions. The findings indicate that migrants in exogamous unions, after the birth of their first child, tend to report lower life satisfaction in Germany (Gawron and Carol, 2022). In terms of mental health, Milewski and Gawron (2019) suggest that migrants benefit from intermarriages. They observe, across nine European countries, that migrants in exogamous marriages are more likely to report lower levels of depression than their counterparts in endogamous marriages, hypothesising that the non-migrant spouse may operate as a source of bridging interethnic social capital with positive consequences on the migrant partner. The same result is confirmed in the study by Eibich and Liu (2021) on older migrants in Germany. In addition, they find that the size of family networks differs by union type.

Based on this literature, we formulate the following research hypothesis for Italy in order to improve our understanding of migrants' health in the country:

1) Migrants in stable unions show better health than their counterparts who are single, widow, or separated/divorced;

2) We expect migrants in exogamous unions to have better health than their counterparts in endogamous unions.

In addition, given that health is a typically gendered dimension (and it was proved to be so also in Italy, e.g., Trappolini and Giudici (2021)), we test our research hypotheses separately among men and women.

3. Data and methods

3.1. Data

We use the unique and most up-to-date Italian survey on foreign citizens, "Social Condition and Integration of Foreign Citizens", conducted by ISTAT during 2011-2012, on a sample of households with at least one member with non-Italian citizenship (hereafter, migrants), providing insights into different aspects of daily life, as well as key socio-economic and demographic information.

The survey collects information on 9,553 households for a total of 25,326 individuals. The data are representative of migrants residing in Italy; therefore, the survey only includes information on migrants regularly settled in the country.

The statistical unit for the analysis is the main respondent. We select only the main respondent (who has to be a migrant, by definition) because in the case of exogamous unions (i.e., a union with a native) the survey does not provide information on Italian individuals. Finally, we exclude individuals below the age of 18 to ensure the reliability of reported health (Breidablik *et al.*, 2009). Thus, our final sample consists of 9,395 individuals (49.7% women).

3.2. Dependent variables

We employ three dependent variables: self-rated health (SRH), mental health and physical limitations. SRH is derived from the question 'How is your health in general?' with five possible answers 'very good', 'good', 'fair', 'bad', 'very bad'. We dichotomise such variable by coding 'very good' and 'good' as 0 and 1 otherwise. The information about mental health is included in the Mental Health Index (MHI, see Ware and Gandek, 1994). MHI scores vary between 0 and 100, with higher scores indicating better mental health. We dichotomise the variable by coding 0 scores higher than 65 (the third quartile of MHI distribution). Finally, information about physical limitations is derived from the following question: 'Do you suffer from limitations in activities usually performed due to health problems?'. We treat physical limitations as a dichotomous variable: 0 'no limitations' and 1 otherwise.

We study multiple health outcomes to better describe migrants' health and capture different health aspects following previous researches on the same topic (e.g., Alderotti and Trappolini, 2022). SRH should capture the general aspect of health in the short-run, while mental health and physical limitations should capture health problems in the long-run.

3.3. Main explicative and control variables

We rely on two main explicative variables in order to test each of our two research hypotheses. The first explicative variable is the marital status. We distinguish between 'single', 'divorced or widow', and 'in couple'. The second explicative variable is the type of union, as we distinguish between 'exogamous unions' (between a migrant and a native), and 'endogamous unions' (among co-ethnics).

We control for a set of socio-economic and demographic variables: age (continuous), educational level ('up to lower secondary education', 'upper secondary or tertiary education'), employment status ('employed', 'unemployed', 'inactive'), area of origin ('Romania, Poland and other countries of Central and Eastern Europe that are not in the EU', 'Africa', 'Asia and South America', 'North America, Oceania and the remaining European countries'), duration of stay ('recent migrants' – i.e., who migrated less than 7 years before the interview , 'long-term migrants' – i.e.,

who migrated at least 7 years before the interview[1]), parity ('childless', 'parents'). Finally, we include information about the reason for migration. When considering the reason for migration, respondents had the option to indicate multiple reasons for their migration. Therefore, we make assumptions in order to identify their primary migration reason. Firstly, if respondents indicate "affective reasons" for their migration, we infer that they have close relatives in Italy, and thus the main reason for migration is categorised as "family reunification," regardless of any other reasons they may have mentioned. Secondly, if respondents do not select "affective reasons" but choose at least one of the following options: "to find a job," "make more money," or "improve life quality," we classify the main reason for migration as "economic/working reasons." Lastly, any remaining migration reasons, such as "study," "war," "persecutions," "to make new experiences," "it was not my choice," or "other," are grouped into a residual category. Descriptive statistics are provided in Table A1 in the Appendix.

3.4. Methods

We conduct two separate analyses using logistic regressions. In the first one, we test the protective effect of being in a stable union on each of the three health outcomes considering the overall population. In this regard, the main explicative variable (marital status) only distinguishes among 'single', 'divorced or widowed' or 'couple' (Table 1).

In the second set of analysis, we focus only on couples and investigate differences in migrants' SRH, mental health and physical limitations between exogamous and endogamous unions. In this case, we compute the predicted probabilities with 83.5% confidence intervals[2] both to avoid the incomparability arising from coefficients obtained from different logistic regression models and to enhance the interpretation of results (Figure 1). All the analyses are stratified by sex.

4. Results

In this section, we address the relationship between marital status and health among migrants. For space reasons, we only show the results about the relationship between each of the three health outcomes analysed and marital status by sex. Table 1 illustrates the Odds Ratios (OR) depicting such a relationship net of age,

[1] The choice of 7 years as a threshold ensures subsamples of sufficient size and has been previously adopted in existing literature (e.g., Trappolini and Giudici, 2021, Alderotti and Trappolini, 2022).

[2] Confidence intervals are centred on the predictions and have lengths equal to 2 × 1.39 × standard errors. This is necessary to obtain an average level of 5% for Type I errors in pairwise comparisons of a group of means (Goldstein and Healy, 1995).

educational level, employment status, area of origin, duration of stay, parity and reason of migration. Results suggest that men and women in a couple have smaller chances of reporting bad SRH (ORs = 0.84 among men and by 0.91 among women), while divorced/widow individuals have higher risks of reporting bad self-rated health; however, these figures are not significant. On the other hand, relevant differences are detected for mental health. We find that both men and women who are in a union are significantly less likely to report poor mental health than singles (OR = 0.65 and OR = 0.69, p-value 0.000, respectively). No remarkable difference arises with divorced/widow individuals. Finally, men in unions have higher ORs of reporting physical limitations, while divorced/widow women have higher ORs of reporting physical limitations; nevertheless, these results are only weakly significant (p-values between 0.05 and 0.10).

Table 1 – *Adjusted OR by marital status and sex, in poor self-rated health, poor mental health and has physical limitations. Reference category: single.*

	Men		Women	
	OR	p-value	OR	p-value
Poor self-rated health				
Divorced/Widowed	1.10	(0.571)	1.09	(0.468)
Couple	0.84	(0.290)	0.91	(0.448)
Poor mental health				
Divorced/Widowed	0.89	(0.421)	0.93	(0.470)
Couple	0.65	(0.000)	0.69	(0.000)
Has physical limitations				
Divorced/Widowed	1.03	(0.905)	1.32	(0.060)
Couple	1.39	(0.100)	0.99	(0.969)

Table notes: Models adjust for age, educational level, employment status, area of origin, duration of stay, parity and reason of migration.
Source: Authors' elaboration on SCIF data (2011-2012).

To address our second hypothesis, we limited our analytical sample to migrants who are in a couple and checked whether there is an association between the partners' migratory background and the respondent's health. Figure 1 displays the adjusted predicted probabilities of reporting bad health for each of the three health outcomes analysed. The figure distinguishes between exogamous and endogamous unions, taking gender into account.

Net of the same set of controls used for the previous analyses, results reveal significant differences for women's SRH and mental health. More specifically, we observe that women in endogamous unions have a 20.0% (95% CI 0.180-0.222) probability of reporting poor SRH, while the same probability for their counterpart in an exogamous union is lower by more than 5 p.p. Similarly, migrant women in a union with a migrant man are more likely to report bad mental health than migrant women in a union with a native man (25% vs. 20%).

As regards men, we do not find significant differences for all health outcomes.

Figure 1 – *Adjusted predicted probabilities by gender and type of union in poor self-rated health, poor mental health and has physical limitations.*

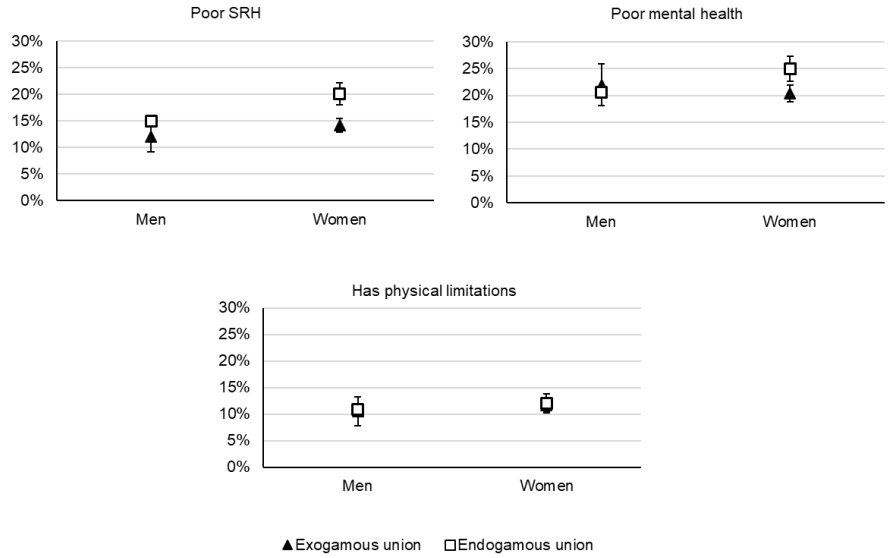

Figure notes: Results from logistic regressions. Models controlled for age, educational level, employment status, area of origin, duration of stay, parity and reason of migration. 83.5% CI.
Source: Authors' elaboration on SCIF data.

5. Discussion and conclusions

This is the first study in Italy to shed light on the dearth of empirical evidence regarding the link between union status and migrants' health.

Using the Social Condition and Integration of Foreign Citizens (2011-2012), the study analyses differences in health between men and women by marital status. In addition, it specifically examines individuals in unions, comparing individuals' health in exogamous with their counterparts in endogamous unions. By analysing this association, our study contributes to the literature on migrants' health and enhances the comprehension of migrant integration processes within the evolving multicultural environment of European countries.

We tested two hypotheses. In the first one, we assumed individuals in unions to be healthier than their single counterparts. The analyses partially confirmed this hypothesis, highlighting that being in union is especially protective against mental health issues for both men and women. This finding was not unexpected, as being in a stable union is known to have a positive effect on health and mortality (e.g., Carr and Springer, 2010) through various possible mechanisms discussed in the literature review; however, our study proves such an effect holds also for migrants in Italy.

We reasonably posit that selection mechanisms may be especially crucial in the case of migrants in unions, as there may be a double positive selection at play – namely, the positive selection of healthy ones i) into migration and ii) into union.

In the second hypothesis, we expected individuals in exogamous unions to perform better than those in endogamous unions. We found evidence for this hypothesis only among women, who have higher probabilities of reporting poor SRH and mental health if they are in an exogamous union than in an endogamous union. These results agree with previous studies about mental health based on different contexts (e.g., Milewski and Gawron, 2019), thus reinforcing the idea that, for migrants, being married to a native corresponds to some gain in health and/or wellbeing (Potarca and Bernardi 2021). Our findings support the hypothesis that exogamous unions may be beneficial not only for mental health and life satisfaction, but also for SRH. However, as regards men, we did not observe any differences.

These findings suggest that when migrants form unions with natives in the destination country, they have the opportunity to broaden their local family network (Koelet *et al.*, 2017; Martinovic *et al.*, 2009), which can have positive implications. The family networks acquired through marriage, or more generally, unions can contribute to enhancing one's social capital, which in turn has the potential to translate into other forms of capital, including improved health outcomes (Bourdieu, 2018; Eibich and Liu, 2021). Actually, the presence of local family ties allows to alleviate some of the risks factors or challenges migrants face in the destination country, such as language barriers and limited access to services (Arai, 2005), which can negatively affect migrants' health (Robila, 2010). While the literature extensively acknowledges intermarriage as an indication of diminishing ethnic and social boundaries for both immigrants and the host society (Blau *et al.*, 1984), comparatively less attention has been placed on exploring the potential advantages associated with acquiring native family members through unions.

Our results also suggest that such differences disproportionately affect women, who both receive and provide more care (Penning and Wu, 2013), in line with previous studies (Eibich and Liu, 2021; Milewski and Gawron, 2019; Potarca and Bernardi, 2021). Conversely, there is a similarity in SRH, mental health, and physical limitations among men in both endogamous and exogamous unions.

This study has some limitations, which are mostly data-driven. Using cross-sectional data, we cannot observe health variations over time and cannot interpret our results in a causal manner. The survey only provides information for the migrant population, impeding the analysis of the health status of the entire couple as we lack data on native individuals. In addition, the relatively small sample size did not allow us to investigate differences by country of origin or reason of migration.

Bearing the limitations in mind, this paper adds to the literature about the comprehension of increasingly diverse European societies, emphasising the

significance of health as a crucial outcome in migrants' life in the destination countries and its interconnection with life course events.

Appendix

Table A1 – *Sample characteristics and distribution of the outcome by sex.*

	Men	Women
Marital status		
Single	20.80	21.89
Divorced/Widow	13.48	33.86
Exogamous Union	6.28	29.02
Endogamous union	59.44	15.23
Age (mean in years)	40.79	42.31
Educational level		
Up to lower secondary	50.13	31.55
Upper secondary & Tertiary	49.87	68.45
Employment status		
Employed	86.10	69.35
Unemployed	7.32	7.28
Inactive	6.58	23.37
Area of origin		
CEE, No-UE, Romania, Poland	47.27	61.90
Africa	27.27	9.45
Asia, Latin-America, Oceania	20.72	19.60
HDC	4.74	9.06
Length of stay		
Recent migrant (<6 years)	19.91	26.00
Long-term migrant (>=6 years)	80.09	74.00
Parity		
Childless	34.47	35.49
Parents	65.53	64.51
Reason of migration		
Work/Economic	80.79	61.92
Family reunification	8.38	25.85
Other	10.83	12.23
Self-rated health		
Very good / good	84.98	79.95
fair / poor / very poor	15.02	20.05
Mental health		
Good	77.17	74.13
Poor	22.83	25.87
Physical limitations		
Yes	9.70	14.52
No	90.30	85.48
N. observations	4,726	4,669

Table notes: Percentage should be read in columns.
Source: Authors' elaboration on SCIF data (2011-2012).

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