THE DEMOGRAPHIC CRISIS CAN AFFECT QUALITY OF LIFE IN ITALY: A MULTI-DIMENSIONAL ANALYSIS[1]

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Abstract. Official data confirmed the inexorable aging of the Italian population. A process historically attributed to the effect of the demographic transitions. However, in Italy it also may be due to specific social/cultural aspects, considering the different performance respect to the other EU countries. Aim of the work is to analyse the progressive aging in Italy in terms both of the increasing weight of older people on youngers, and of other dimensions related to the aging of the population (as the labour force market, the households' structures, marriage behaviours, etc.), focusing the Italian demographic dynamics in a multidimensional approach. The hypothesis is that the aging of the population will inevitably affect the future quality of life in Italy. Anticipation practice need robust scenarios based on official data. For this reason, the work uses the Equitable and Sustainable Well-being data jointly with mortality statistics and other demographic indicators, analysed by the Dynamic Factor Analysis method.

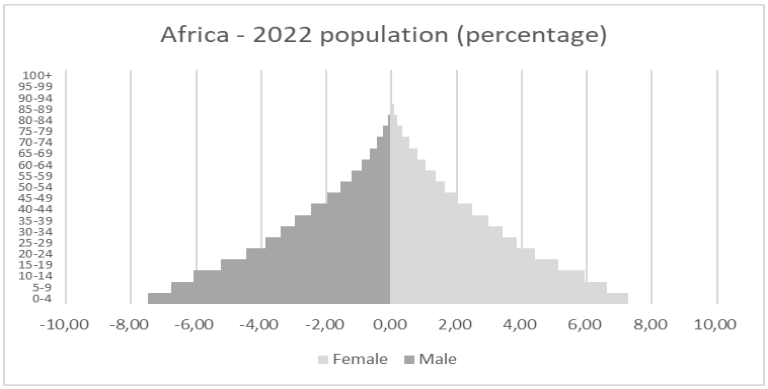
1. Age pyramids and social complexity

In 2022[2] the number of new-born children in the world, according to United Nations data, significantly decreased respect to past. People aged 0-4 are in a smaller percentage than the immediately higher age group (5-9 years). This is true even in countries where the fertility rate is still high. For centuries, everywhere in the world, the composition by age group has been similar to that of the African continent in 2022 (Figure 1). A significant disproportion between new-borns and the adult population can put the future dynamics of a country at risk. This is the case of Italy.

[1] The work is the result of the overall contribution of the authors. However, paragraphs 1, 2, 4 are attributable to Carolina Facioni, while paragraph 3 is attributable to Isabella Corazziari. The views expressed in the paper do not necessarily reflect those of the authors' affiliation institution.

[2] The age pyramids in the paper are the result of elaborations of the year 2022 revised data provided by United Nations, Department of Economic and Social Affairs, Population Division.

Figure 1 – *African population by age and sex: year 2022. (Per 100 individuals).*



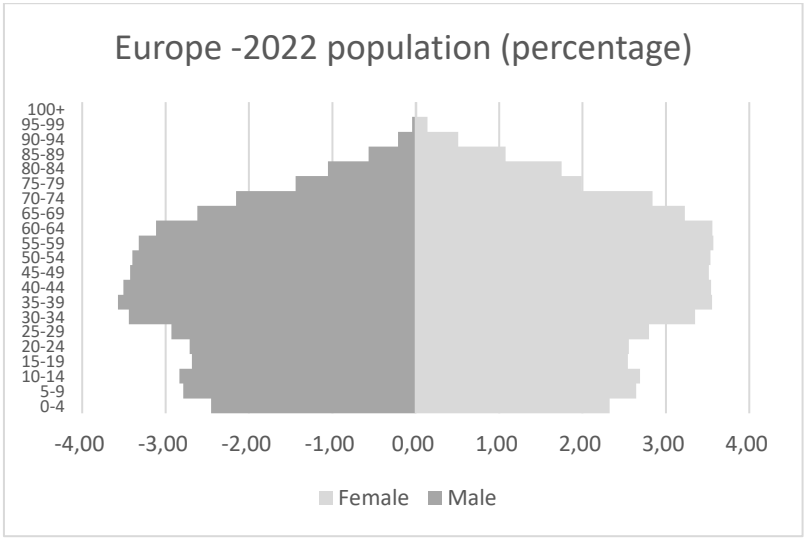
Source: United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2022 Revision. (Medium variant).

Population aging is the result of the combined effect of two distinct factors: a high life expectancy and a low fertility rate. These two elements are the result of two demographic transitions: the one that slowed down mortality and allowed people to live longer (the older of the two) and the one that reduced births (it started about in the 60s of the last century). Both of these factors were the result of civilizational achievements.

Furthermore, life expectancy increases not only due to scientific achievements, but also because of both a medical care available to everyone, and a widespread healthy lifestyle. In synthesis, a good life expectancy is due to a widespread good quality of life. On the other side, the possibility of birth control makes parenthood the result of a responsible decision. People, especially young people, can face it at the most appropriate moment. So, also birth control is concerning the quality-of-life topic.

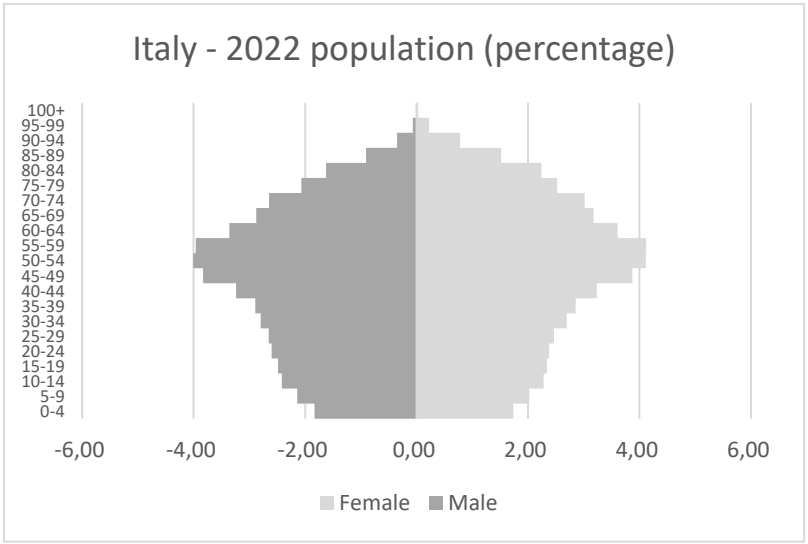
It is worth focusing on the social aspects related to the "right time" to have children in Italian context. In fact, from this specific point of view, Italy represents a sort of borderline case, due to a historic impasse that will be maybe extremely difficult to resolve (Golini, 1997, 2001). In 2022, the demographic crisis in Italy, respect to European context, is evident by comparing Figures 2 and 3.

Figure 2 – *European population by age and sex: year 2022. (Per 100 individuals).*



Source: United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2022 Revision. (Medium variant).

Figure 3 – *Italian population by age and sex: year 2022. (Per 100 individuals).*



Source: United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2022 Revision. (Medium variant).

The age pyramids make it clear that Europe's population is aging as a whole, but Italy is aging more drastically and faster respect to the European trend. In Italy, it is faster respect to other secular, prosperous and industrialized European countries[3] like Germany[4]. What future can we think of for the Italian population? Considering the UN data for 2022, the total Italian population is 59,037,474 people; the largest group is made up of people aged 50-59 (9,566,566 individuals); children in the 0-4 age range are instead only 2,106,488. Italian official data say that in 2022 the average number of children per woman is 1.24, while life expectancy at birth is 82.6 years (Istat, 2023a). The median scenario referring to 2040 (Istat, 2021b, 2022c) shows an increase in people living alone, as well as in couples without children. Can we imagine the quality of life in a country that in twenty years will be made up mainly of elderly people? It is evident that such a particular situation requires immediate attention and policy measures. Keeping a good level of quality of life (Maggino, 2022) in our country requires very serious anticipation (Poli, 2017) work. A work that can rely on reliable data, such as the official data available in Italy.

2. Being young in Italy: the difficulty of reaching adulthood

Having one of the highest life expectancies in the world is a success a nation must be proud of, it is necessary to understand the reasons why the fertility rate in Italy is one of the lowest in the world. The historic research of IARD (IARD, 1988, 1993, 1997, 2003, 2007) can help. IARD identified five key steps in young people's lives for their attainment of a life as an adult. These were the steps identified: 1) having completed the education path; 2) having found a job; 3) having left the parental home; 4) forming a stable relationship; 5) (eventually) having children. Getting the n.5 goal is probably conditioned by the previous four. However, these are undoubtedly five fundamental steps in life - and they are of particular interest in this context, as the official data available to us can explain much of why in Italy there fewer and fewer children over the years are. Table 1 illustrates the different situation between Italy and EU-27 in years 2008, 2014, and 2020 (Istat, 2022c).

[3] Economic prosperity and an industrial and/or tertiary type economy are usually the socio-cultural terrain where the processes of secularization (characterized by phenomena such as the increase in divorces and the decrease in births) develop (Impicciatore and Billari, 2012)

[4] The choice of Germany as a term of comparison is due to the need to highlight the Italian disadvantage in Europe. It would not have been clear enough if the authors had chosen a country like, e.g., Sweden or Denmark - whose welfare aimed at aimed at the quality of life of young people is well known. Furthermore, the authors did not choose a European country already successfully implementing policies for the recovery of the birth rate, such as France. A useful website for comparing all age pyramids using UN data is https://www.populationpyramid.net/.

Table 1 – *People aged 30-34 who graduated and people aged 18-24 who left their studies early. Comparison Italy - EU-27. Years 2008, 2014 and 2020 (Per 100 individuals with the same characteristics).*

Education	Italy			EU-27
	2008	2014	2020	2020
People aged 30-34 with university degree	19.2	23.9	27.8	41.0
People aged 18-24 who early left the education and training system	19.6	15.0	13.1	9.9

Source of data: Istat Report on education levels in Italy (published on October 25th 2022)

Italy still lags behind the European average. Furthermore, school dropouts increased during the Covid-19 pandemic (Istat, 2022a, 2022b). Considering master's degrees, the average age at graduation in Italy is 27.1 in 2022 (AlmaLaurea, 2023). A separate chapter deserves the phenomenon of NEETs (Alfieri *et al*., 2015). In 2022, the data on the total number of NEETs aged 15-29 is equal to 19.0% of people in the same age class - a better percentage respect to year 2020 (23.7%), and better than the 23.1% of year 2021 (Istat, 2023b). Although the data show an improvement, the percentage of NEETs in Italy is still higher than the EU average (11.7%) in 2022[5]. With regard to the labour market, according to the latest Istat Annual Report (Istat, 2023c), Italy is the European country with the oldest workforce. The share of 15–34-year-olds in the total labour force aged 15-64 decreased even more significantly respect to the reduction observed for the population, while it was stronger the increase in the weight of the 50-64 age group. A very complex situation (especially with respect to female employment), on which policies should focus, especially in light of the possible opportunities offered by the NextGenerationEU (MEF, 2022). Even considering the abandonment of the parental home, young Italians are in a different condition than the European average. In the EU, on average, boys left their parental household at the age of 27.4 and girls at 25.5 in 2021. Italian data indicate an average of 29.9 years, which, however, rises to 30.9 for males. Women leave home shortly before with an average of 29.8 years. There is a reasonable correlation

[5]About EU statistics on NEETs, see: https://ec.europa.eu/eurostat/statistics-explainde/index.php?title=Statistics-explained/index.php?title=Statistics_on_young_people_neither_in_employment_nor_in_education_or_training

between the step of abandonment of parental home and formation of a new couple, due to a traditional marriage or a more uxorio cohabitation. In 2019, there were 184,088 weddings celebrated in Italy. The percentage of marriages is declining, especially for the first weddings. Cohabitations more uxorio quadrupled from 1998-1999 to 2018-2019, passing from about 340 thousand to 1 million 370 thousand. The average age at first marriage is 33.9 for men, and 31.7 for women (Istat, 2021a). These last data are crucial for our analysis. If none the circumstances that should help young people form a couple (and therefore have children) is conducive to this aim (Ambrosi and Rosina, 2009; Del Boca and Rosina, 2009), a couple forms relatively late and have the first child late (Golini and Lo Prete, 2019). In Italy, the average age of women having their first child was 31.3 in 2019, while the average age in Europe was 29.4. Having the first child late means having subsequent difficulties in having others. Italy becomes an increasingly old country. The Dynamic Factor Analysis with which the indicators will be analysed below has, in the intentions of the authors, the advantage of enriching the analysis of demographic aging with a temporal element, thanks to which the evolution of the multivariate phenomenon described by some selected well-being indicators is much clearer.

3. Materials, methods, and the results

In order to address the changes of the above-discussed scenario over the last years, a descriptive multiway analysis (Dynamic Factor Analysis DFA) has been performed considering the demographic and labour market indicators available for the Italian regions (NUTS2[6]) in years 2004-2022, from ISTAT data warehouse[7]

The Dynamic Factor Analysis (hereinafter DFA), proposed firstly in 1970s and improved since 1990s (Coppi & Zannella, 1979; Corazziari, 1999; Facioni, 2019) models multivariate data collected over time[8]. It consists in the joint application of factorial methods (Principal Component Analysis) and time regression models to specific covariance matrices addressing particular source of data variation. No inferential assumptions are included about the process generating data, the method aims to describe data variability. The three sources of variation refer respectively to the average over time relationships between Italian regions and indicators (*static*), the average interaction between the indicators and time (*dynamic of centers*), the Italian regions dynamic over time considered as *differential* or net compared to the indicators' average dynamic. The *differential dynamic* can strengthen the mean

[6] https://ec.europa.eu/eurostat/web/nuts/background

[7] Descriptions of the indicators and corresponding source can be asked to the authors. Details about data processing and imputation for missing data/periods can be asked to the authors.

[8] DFA works with complete data matrices. Missing data have to be imputed before performing DFA.

indicators' trend over time or move in other directions, weakening or even contrasting the overall dynamics.

In this work, we use the first DFA model[9], which focuses on the variability of the indicators and their interaction with the other two dimensions. In the first DFA model the *dynamic of centers* is described by ordinary least squares time regression models (OLS), the *static* variability by a PCA of the corresponding covariance matrix and on the same PCA space the unit trajectories over time allow evaluating the *differential dynamic*. Trajectories can be clustered according to their closeness and shape using Cluster Analysis on specific distance matrices (Blanco et al. 1999). If one region or cluster moves toward the centre of the PCs' space (which characterizes the overall dynamic of the system of data) homogeneity among Italian regions is increasing. By contrast, if the unit or cluster move away from the centre of the axes, its differential dynamic is to be interpreted accordingly to its direction. Finally indexes of the goodness of fit of each source of variation are also provided as the ratio between the modelled total variability (trace of the covariance matrix) and the corresponding observed one.

The following table shows the goodness of fit indices related to each source of variation analyzed in the first DFA model.

Table 2 – *Index of goodness of fit.*

Quality index	Description	Value
Overall index	overall covariance matrix	0.75
Regression analysis	dynamic of centers	0.66
Factorial analysis (PCA)		
	static.	0.87
	differential dynamic over time of Italian Regions	0.53

The DFA describes the 75% of the overall variability, the factorial analysis account for the 87% of the static variability, while the regression describes the 66% of the centres dynamic. Indices of fit for each year can also be provided[10].

Considering regression results, few variables show nonlinear variability over time or are constant; the others present good regression results[11].

Main results are that the birth rate is linearly decreasing, the population is slightly ageing and life expectancies at 0 and 65 years for both males and females increasing. Consequently, Elders' burden on Youngers and on labour force is linearly increasing. Marriage rates are decreasing over time, with the exception of second or

[9] The DFA consists of four models, each of which defines a specific strategy to address the three sources of variation (Corazziari 1999, Facioni et al 2019).

[10] Values can be asked to the authors

[11] Details can be asked to the authors.

more marriages of older people realistically less interested in reproductive behaviours. The Labour Force (LF) is ageing as over 55 are increasing and the proportion of 15-34 on the total LF decreasing. Couples with both partners, or only the woman employed are slightly increasing, so as the proportion of couples with no partner employed and no employment pension. Within the described ageing Labour Force market, the proportion of NEET young people, not studying and not looking for a job, is increasing for both males and females. Also, the proportion of young people aged 30-34 with at least a university degree increased since 2004, while decreased those of young people aged 18-24 who left the studies. In the same period, the proportion of people still living at home with parents especially if looking for a job or students increased in the group of people aged 18-34.

The PCA of the *static* variability provided two principal components (PCs). Following a circle counterclockwise on the bottom, we start from a situation characterized by more elderly people, graduates, women with little children possibly employed, couples with both partners employed. Then, we found higher birth rates and number of children by woman. On the right, we find higher proportion of young people on the total LF and consequently higher rates of Youngers who left the study early, higher marriage rates for Youngers and first marriages.

Then worst situations follow higher proportion of couples without a job nor an employment pension or only the man employed, higher NEET rates and young people (18-34) still living with parents looking for a job. Finally higher proportions of workers over 50 on the total LF and students (18-34) still living with parents.

Projecting the mean of the Italian regions over time, the PCA's plane contrasts the Northern on the left of the plane versus the Southern ones on the right, with the former characterized by better employment opportunities with respect to the latter representing a more traditional society with more marriages and the man providing economic resources for the family[12]. A hierarchical cluster analysis of the regions' time trajectories to describe the regions' differential dynamic over time provided a partition of 4 clusters, the first two involving respectively Northern and Central regions (Liguria and Abruzzo the exceptions) and the last two clusters splitting Southern regions and Islands.

[12] Details can be asked to the authors.

Table 5 – *Cluster analysis of trajectories: size of each cluster.*

Cluster	Cluster size	NUTS2 regions
1	8	Piemonte, V.d'Aosta, Lombardia, Bolzano, Trento, Veneto, Friuli VG, Emilia-Rom.
2	6	Liguria, Toscana, Umbria, Marche, Lazio, Abruzzo
3	3	Molise, Basilicata, Sardegna
4	4	Campania, Puglia, Calabria, Sicilia

The second and third clusters show low dynamic over time. The Cluster 2 dynamic shows an improvement for the employment rates and an ageing of the population. Cluster 3, referring to Sardinia, Basilicata and Molise, after a slight worsening for Younger's opportunities seems to reduce distances from, he others.

The first and fourth cluster, show a high dynamic over time, but in opposite directions and consequences. Cluster 1, referring to the Northern regions except Liguria, increases employment rates in years 2009-2019 for people aged more than 25 and especially for males. Finally, the cluster 4 shows a worsening dynamic, moving away from the centre towards the worst situation for Youngers in terms of labour opportunities and of trust in the future (NEET young people).

4. Conclusions

This work attempted to provide a multidimensional - albeit synthetic and necessarily partial - vision of the problem, enriching the picture with a temporal dynamic of the phenomenon, and outlining the picture of a (present, and maybe future) crisis. Anyway, this data can be precious for future policies if put in connection with other indicators: for example, with the labour market's indicators, with the school system's indicators, with other aspects linked to satisfaction (e.g., the propensity to marriage among young people), etcetera. Suffice it to consider, among the many results that have emerged, how young Italians can no longer consider (as happened in the past) the possession of a high qualification as a sure springboard for a better and more qualified job. In Italy, the lack of work affects family life plans: this affects lower marriage rates, and the average age of first child, which is increasing. One of the effects of this complex situation is the collapse of births in Italy, with the consequent aging due to the combined very high life expectancy. The analysis of data tell us about the crisis of many fundamental aspects for the quality of life of Italian citizens. The results provide a picture that illustrates a progressive worsening of some dimensions, which decision makers must put a stop to in time. It needs policies related to welfare state (Baldacci and Lugaresi, 1996). The crisis was predictable. Eleonora Barbieri Masini, theorist and founder of Futures

Studies, did it in the 1970s (Facioni, 2019). Italy has lost years in which it could have done a serious job of anticipation by preventing the crisis. In 2022, Gian Carlo Blangiardo (president of Istat at the time), underlined how a "demographic winter" could have consequences on GDP in the future, but a possible collapse could be not only of an economic kind, but related to overall well-being. An aged nation is destined too no longer be competitive. It is necessary to improve the lives of young people, to allow them to enter a dignified adult life. For example, giving them a dignified and guaranteed work, in particular to women. Policies that support young couples' lives should be high on the public agenda. From a completely different point of view, policies should review the concept of "elderly" in Italy. The hypothesis that, in the next few years, a small group of young workers will maintain an army of retired people (born in the years of the economic boom) is not tenable. Italy needs a change in terms of demographic rejuvenation. It affects everyone's quality of life in the coming years. Italy needs to anticipate its own future.

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