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The Population Ageing in Italy: is it Really Exceptional?

by

Marianna Brunetti

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Università di Modena e Reggio Emilia
Dipartimento di Economia Politica
Via Berengario, 51
41100 Modena, Italy
e-mail: brunetti.marianna@unimore.it

The Population Ageing in Italy: is it really exceptional?

Marianna Brunetti

*University of Modena and Reggio Emilia and CEFIN**

Abstract

Population ageing is a world-wide phenomenon with manifold implications ranging from health to social and economic fields that ultimately depend on the magnitude of the phenomenon, which sensibly differs across countries. In the debate over the social and economic consequences of ageing, Italy is often recalled as an exceptionally "greying" country. The aim of this paper is to provide detailed empirical evidence on the dimension of population ageing in Italy by means of both historical and forecast data over the period 1950-2050. Based on United Nations and Eurostat data a comparative analysis shows that Italy is one of the countries in the world most affected by ageing. In fact, if Europe emerges together with Japan as one of the world areas most afflicted by ageing, within Europe, Italy definitely comes out for the dynamics of the phenomenon. Further analyses on the major causes of the peculiar ageing in Italy highlight the role of a sensible drop in fertility. In a companion paper, Brunetti and Torricelli (2006) focus on an important economic implication of these results, i.e. the impact of such a strong ageing dynamics on household portfolios in Italy.

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1. Introduction

Population ageing is a world-wide phenomenon with manifold implications ranging from health to social and economic fields. However the size of the phenomenon, and hence of its side-effects, sensibly differs across countries. In the debate over the social and economic consequences of ageing, Italy is often referred to as an exceptionally "greying" country.

The aim of this paper is to provide specific empirical evidence on the dimension of population ageing in Italy. To this end, the phenomenon of ageing in Italy is analysed also at a comparative level by means of both historical and forecast data provided by the United Nations (UN) and Eurostat over the period 1950-2050. More specifically, the phenomenon of ageing is described using data on the evolution of the median age as well as dependency ratios. In addition, data on fertility, mortality and migration are employed to better identify the main causes of the demographic evolution occurred in Italy.

Based on the present paper results, n a companion paper Brunetti and Torricelli (2006) analyse how such ageing dynamics can affect household portfolio choices and ultimately financial markets in Italy. In fact, elderly people usually have lower saving rates and higher average risk aversion and ageing is going to bring about a progressive evolution of financial needs and investment requirements, which may in turn translate into changes in prices and returns of existing financial instruments and in the need for new ones. Our analysis aims to contribute to a lively debate on the issue (see among many others: Ameriks and Zeldes (2004), Davis and Li (2003), Guiso and Jappelli (2001), Poterba, 2001, 2004).

The paper is structured as follows. In the next Section the main stylized facts about ageing in Italy are analysed and discussed at a comparative level with respect to the rest of the world and in particular with Europe. In the third Section the peculiarity of the Italian case is analysed and its main causes are investigated. Last Section concludes. The Appendix provides a description and a comparison between the two database used.

2. Population ageing in the world

Since the dimension of the phenomenon may differ across countries, the first step of this research is to assess the magnitude of the phenomenon in Italy with respect to other developed countries and in particular to the European ones. Data are taken from two international databases, namely those provided by United Nations (UN) and Eurostat[1], whereby the UN database is more suitable for the worldwide comparative analysis and Eurostat for the analyses specifically focussed on Italy.

The changes in the population age-structure can be assessed by means of different measures, which can either relate only to the demographic structure of the population, and are thus univocally defined, or depend also on institutional factors (e.g. pension systems) beside the demographic ones. As for the former type of measure, the most widespread ones are: the median age, the average age and the life expectancy at birth. As for the latter, the most widespread is the old-dependency ratio that is the relative amount of retired people to the working-age population.

This Section provides a comparative analysis of the demographic evolution occurring in Europe and in the rest of the world, using data spanning over the period 1950-2050 and taken from the UN demographic dataset. As described in the Appendix, both UN and Eurostat databases provide several demographic "projections variants", obtained combining different hypotheses on fertility, mortality and migration. Data used in the following analyses refer to the variants which are deemed the most likely for the future in the two databases, namely "Constant-fertility" for UN and "Baseline" for Eurostat.

Among other demographic measures, the dataset provides: (i) median age; (ii) life-expectancy; (iii) percentage of young, defined as people aged 14 or less; (iv) percentage of old, defined as people aged 65 or over; and (v) old-dependency ratio, defined as the ratio of aged 65 or more to aged 15-64. Main findings are summarised in Table 1 and in Chart 1.

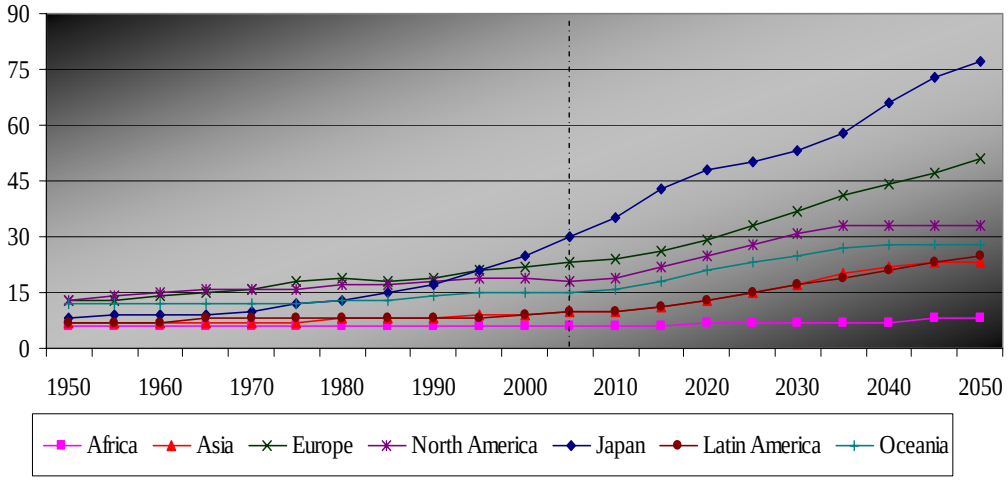
[1] Data are available on the United Nation Population Division website: http://esa.un.org/unpp/ and on the Eurostat website: http://epp.eurostat.cec.eu.int/. A comparative description of the two datasets is provided in the Appendix.

Table 1: Demographic measures in major world-regions: past, present and projected.

World-zone	Years	Median Age	Life Expectancy	Old - dependency Ratio	% Old	% Young
Africa	***1950***	19	38.4	6	5.3	42
	2005	18.9	50	6	5.2	41.5
	2050	18.6	65.3	8	6.2	43.6
Asia	***1950***	22	41.4	7	6.8	36.5
	2005	27.7	68.7	10	9.3	27.8
	2050	32.8	76.9	23	19	26.2
Europe	***1950***	29.7	65.6	13	12.1	26.2
	2005	39	74.3	23	20.7	15.9
	2050	50.1	80.7	51	37.2	12
Latin America	***1950***	20.2	51.4	7	6	40
	2005	25.9	72.9	10	8.8	30
	2050	33.1	79.4	25	19.7	25
North America	***1950***	29.8	68.8	13	12.4	27.2
	2005	36.3	78.2	18	16.8	20.5
	2050	40	82.7	33	26	18.3
Oceania	***1950***	28	60.4	12	11.1	29.9
	2005	32.3	75	15	13.9	24.8
	2050	35.9	80.5	28	21.8	23.5
Japan	***1950***	22.3	63.9	8	7.7	35.4
	2005	42.9	82.8	30	26.3	14
	2050	56.2	88.3	77	45.5	9.7

Data Source: United Nations Population Prospects.

Chart 1: Old-dependency ratio from 1950 to 2050: major world-regions.



Data Source: United Nations Population Prospects.

The most severe population ageing has been experienced by Japan and Europe: in both countries median age and old-dependency ratios have increased much more than in the rest of the world. Given that this conclusion is consistent across all demographic measures considered, we restrict our attention to these two areas and we disaggregate the analysis for the 25 countries of the European Union to further focus on the case of Italy. For reasons of space we report only the old-dependency ratio: Table 2 ranks countries according to the value expected for this demographic indicator in 2050.[2]

Table 2: Old-dependency ratios.

Country	1950	2005	2050	Country	1950	2005	2050
Japan	8	30	77	Lithuania	15	23	52
Italy	13	30	75	Malta	10	20	52
Spain	11	24	72	Belgium	16	27	50
Czech Republic	12	20	64	France	17	25	48
Slovenia	11	22	64	Estonia	17	24	47
Austria	16	25	58	Finland	11	24	47
Greece	11	27	57	Netherlands	12	21	45
Portugal	11	25	57	Sweden	15	26	44
Slovakia	10	17	57	Ireland	18	16	43
Latvia	18	25	55	UK	16	24	40
Poland	8	18	55	Cyprus	10	18	38
Germany	14	28	54	Denmark	14	23	38
Hungary	11	22	53	Luxemburg	14	21	36

Data Source: United Nations Population Prospects.

Two observations are here in order. First, the process of population ageing seems to affect quite strongly several of the new EU members (entered with the enlargement on the 1st of May 2004), and in particular Slovenia and Czech Republic.[3] Second, Italy is the sole country whose projections are as high as Japan's.

In fact, Italy is first together with Japan for the future value of median age, which by 2050 is expected to attain the value of 56.2 in both countries. The same holds for the share of old population and for old-dependency ratio, whose expected values are

[2] Similar tables made according to other demographic measures (available upon request) are consistent with Table 2.

[3] A huge debate is currently ongoing on the population ageing in the Eastern European countries and on the policy implications that it may have on the whole European Union. See, among others, Kucera et al. (2000) and the studies performed within the research program "Demographic & Social Change in Eastern Europe" carried out by the Department of Development Sociology of Cornell University, the Demography and Geodemography Department of the Charles University of Prague and the Department of Sociology of the University of Bucharest in Romania together with the Universities of Central Florida and Kansas State and the Echo Survey Sociological Research Institute (Hungary).

second only to Japan. As for life expectancy in 2050, Italy with 85.1 years is third after Japan with 88.3 and Sweden with 85.5, whereby the latter already experiences one among the highest life expectancies in Europe.

In sum, two separate conclusions can be drawn. First, Europe emerges together with Japan as one of the world areas most afflicted by population ageing. Second, within Europe Italy definitely comes out for the strength of the undergoing transformations of its age-structure.

3. What is peculiar in Italy?

In order to better understand the peculiarity of the Italian case, in this Section we take a closer look at the evidence for Italy and at its determinants. To this end we address the following issues:

1) the past and future dynamics median age, life expectancy and old-dependency ratio;
2) the distribution of different age-classes over the entire population at different points in time;
3) the factors that typically underlie demographic transitions, i.e. fertility, mortality and migration.

3.1 A closer look at demographic indicators in Italy

Table 3 reports the past (1950), the current (2005) and the projected future values (2050) for Italian median age, life expectancy at birth and old-dependency ratio. Chart 2 provides a plot of the same measures.

Table 3: Main demographic measures for Italy, 1950-2050.

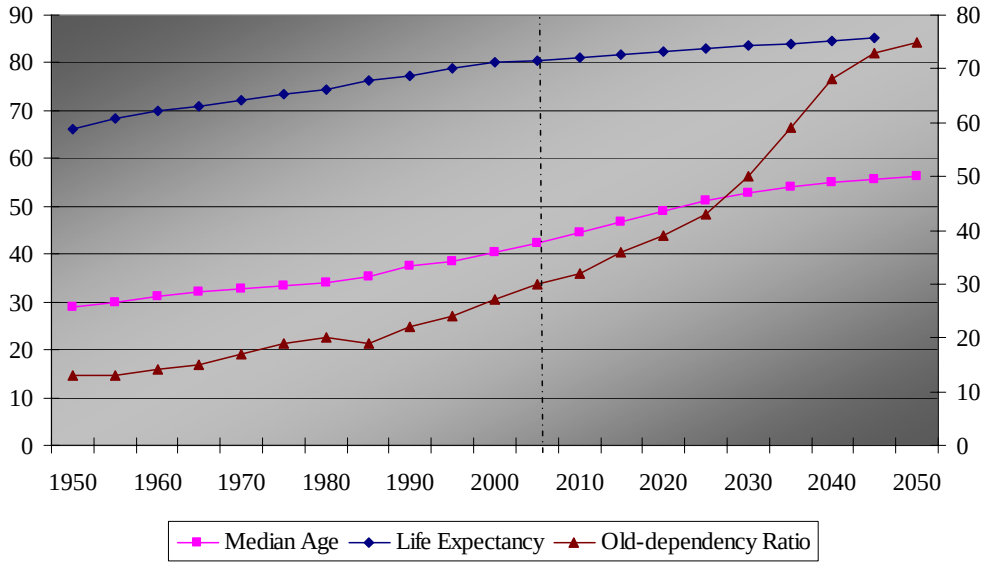
Demographic Measure	**1950**	**2005**	**2050**
Median Age	29	42.3	56.2
Life Expectancy	66	80.6	85.1
Old-dependency Ratio	13	30	75

Data Source: United Nations Population Prospects.

Since the mid of last century Italian median age has risen from 29 to 42.3 years and a similar increase is expected to occur by 2050, when it is projected to reach 56.2

years. Analogously, life expectancy has also increased (on average three months every year) and a further enhancement is estimated over the next 50-year period. The most remarkable change has been recorded by the old-dependency ratio, jumped from 13 in 1950 to 30 in 2005 and expected to more than double by 2050 when, according to UN projections, in Italy there will be around 75 retired every 100 working people.

Chart 2: Main demographic measures in Italy: evolution and forecast.



Note: values for median age and life expectancy(in years) can be read on the left scale, while those for old-dependency ratio (in percentage) are reported on the right-hand-side scale.
Data Source: United Nations Population Prospects.

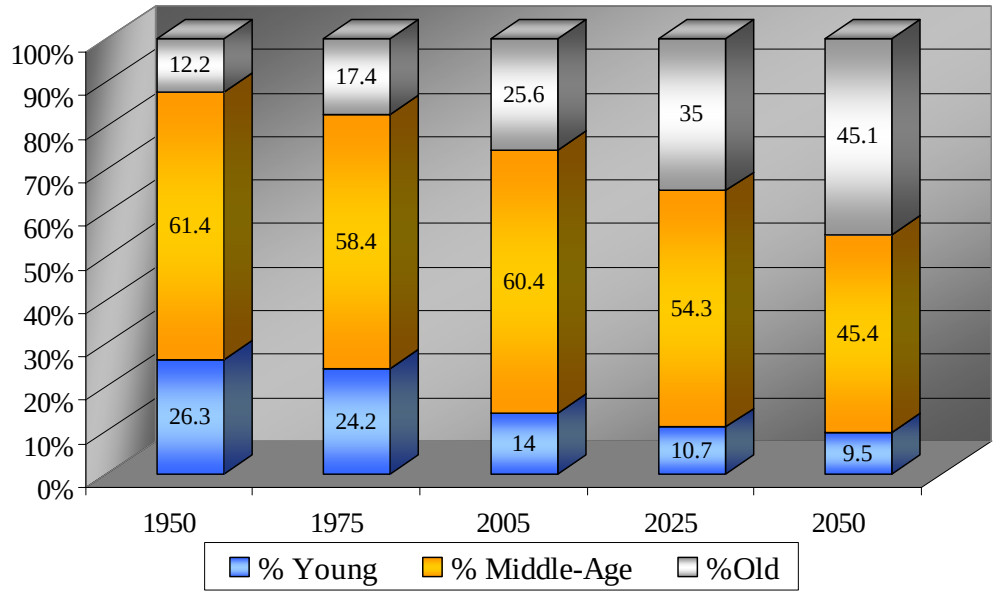
3.2 The dynamics of the age classes

As for the dynamics of different age classes, the dramatic Italian demographic evolution is highlighted by Chart 3, where the shares of young, middle-aged and old people over the entire Italian population are plotted at five different points in time, two in the past (1950 and 1975), one current (2005) and two in the future (2025 and 2050).

During the last 50 years, the share of middle-aged has remained almost unchanged while young people have decreased by more than 10 percentage points. Conversely, the proportion of elderly has undergone a progressive enlargement, raising from the 12.2% of the total Italian population of 1950 to the 25,6% reached in 2005. The projections for the next 50-year period point towards a further enhancement of the phenomenon. The working age population is likely to shrink more and more relatively

to inactive individuals and in particular to elderly people: the greying population is enlarging up to 35% in 2025 and to more than 45% by 2050, i.e. nearly the same as middle-aged people.

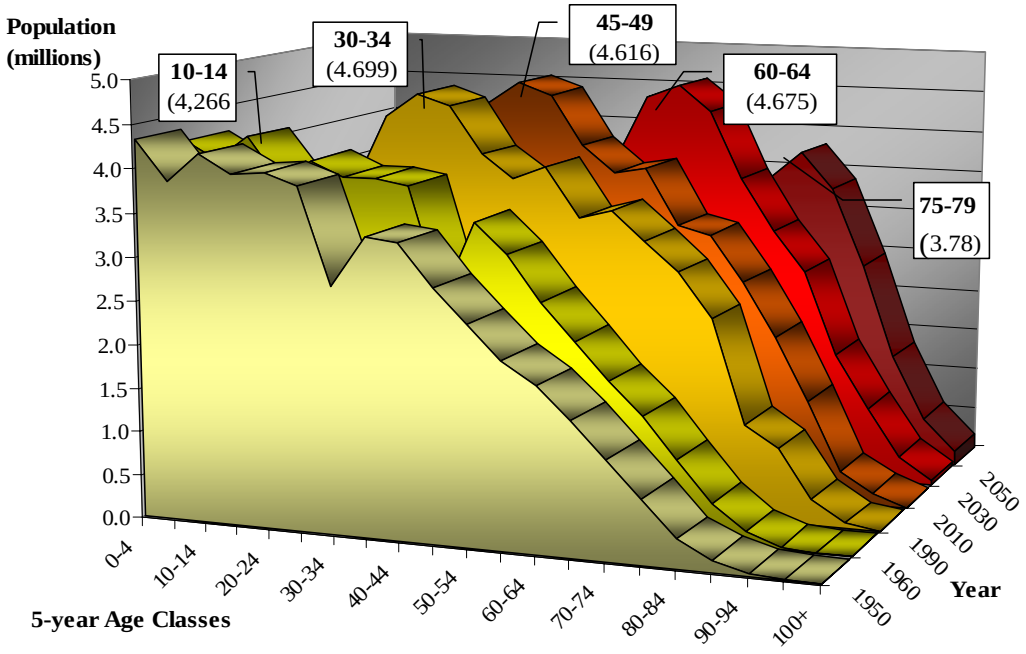
Chart 3: Shares of young, middle-aged and old individuals in Italy.



Data Source: United Nations Population Prospects.

Chart 4 represents the Italian demographic evolution in more detail as smaller age-classes, of 5 years each, are used. The distribution of Italian population is represented at various points in time, namely 1950, 1960, 1990, 2010, 2030 and 2050. The baby boom, occurred in Italy during the 1960s, is clearly visible as the population peak, which represents the baby boomers generation, moves as a wave: in 1970s it corresponds to the very young (around 10-14 years old) part of the population, at the beginning of the new century it represents the middle-aged (30-34) and late-middle-aged (45-49) and at the end of 2050s those aged around 75-79: thus, up to the mid of this century the baby boomers will still represent the most conspicuous age-class of the population, being almost 4 millions people.

Chart 4: Italian population distribution by age-classes: evolution.



Data Source: United Nations Population Prospects.

3.3 Determinants of population ageing

Population ageing might stem from a relative decrease in fertility, a relative lower mortality (i.e. greater longevity) and/or a relative decline in the net migration. In order to single out the major causes of the exceptional demographic transition in Italy, we examine the three main factors that drive demographic changes: i.e. fertility, mortality and migration flows. In this analysis Eurostat dataset is used since it supplies more detailed demographic measures.

The directions that each factor is expected to take to lead to population ageing are summed up in the third column of Table 4. In order to clarify which among them has played the major role in the Italian ageing experience, the historical evolution of each factor is observed over the last 50-year period (15-year period for net migration) by means of different measures. More specifically, fertility is assessed by means of the birth rate (ratio of births to average population) and the total fertility rate (average number of children born to a woman), mortality by means of the life expectancy at birth and the death rate (ratio of deaths to average population) and migration flows by means

of the net migration (difference between immigrants and emigrants) and net migration rate (net migration to country population).[4]

Table 4: Factors underlying ageing: theoretical and effective changes.

Factor	Measure	Expected change	Effective Change (1950-2005)
Fertility	Birth rate	↓	- 10.1
	Total fertility rate	↓	- 1.04
Mortality	Death rate	↓	+ 0.8
	Life Expectancy (yrs)	↑	+ 14.6
Migration	Net Migration Flows	↓	+ 170.000
	Net Migration Rate	↓	+ 0.3 %

Note: data for migration refer to the period 1985-2000 only.
Source: author computations on Eurostat Demographic Database.

Table 4 highlights that only the two fertility measures and life expectancy have actually registered the expected change. Given the overall strong ageing observed in Italy, this means that decreased fertility and increased longevity have more than offset the other effetcs. Thus a closer look at these measures is in order at this stage.

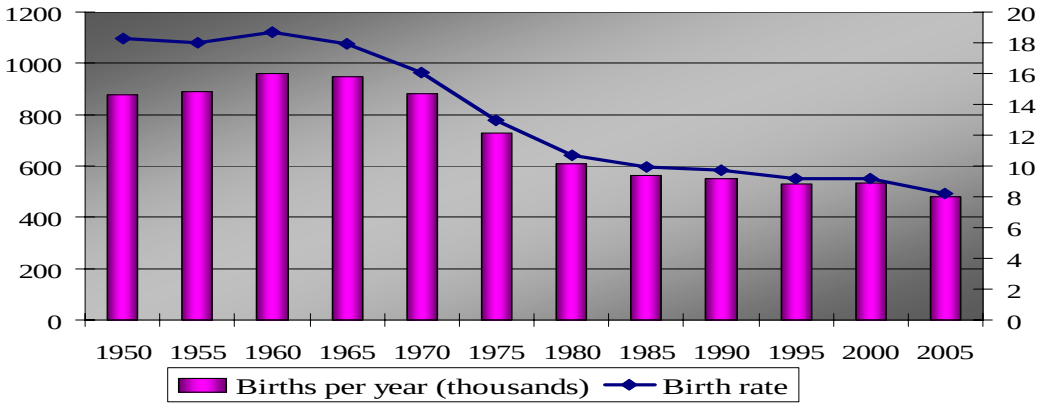
Chart 5 plots the evolution of absolute number of (live) births and of the birth rate from 1950 to 2005. Both births and birth rate follow an "s" pattern. First, a peak is highlighted between 1955 and late 1960s, which clearly denotes the baby boom occurred in Italy after the Second World War. Immediately after, there is a substantial drop which makes the birth rate more than halve before stabilizing around the current level of 8.2. A very similar pattern is followed by the total fertility rate (see Chart 6). According to the expectations, all the indicators examined point towards a substantial decline in fertility.

Chart 7 plots the absolute number of deaths and the death rate in Italy over the period 1950-2005. Both increased over the last 50 years: the former of around 1 million and the latter of 0.8 percentage points, moving from 9.9 to 10.7. On the other hand, as plotted in Chart 8, life expectancy has risen form the 66 years that a newborn in 1950

[4] Others measures could have been considered. Fertility measures include the absolute number of births and the net (gross) reproduction rate, i.e. the average number of daughters that would be born to a woman subjected to the current fertility and (neglecting) mortality conditions. Similarly, mortality can be assessed by means of the absolute number of deaths. Here, we prefer relative rather than absolute and complete rather than partial measures (e.g. reproduction rates consider the number of daughters only).

was expected to live to the current 80.6 years, thereby more than offsetting the negative effects that the death rate increase could have had on population ageing.

Chart 5: Absolute number of births and birth rate in Italy, 1950-2005.



Note: values for births are on the left scale; those for birth-rate are on the right-hand-side one.
Data Source: Eurostat Demographic Database.

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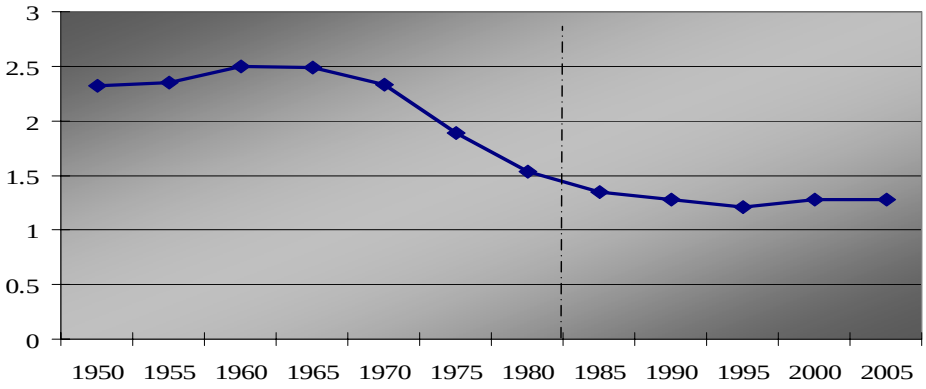
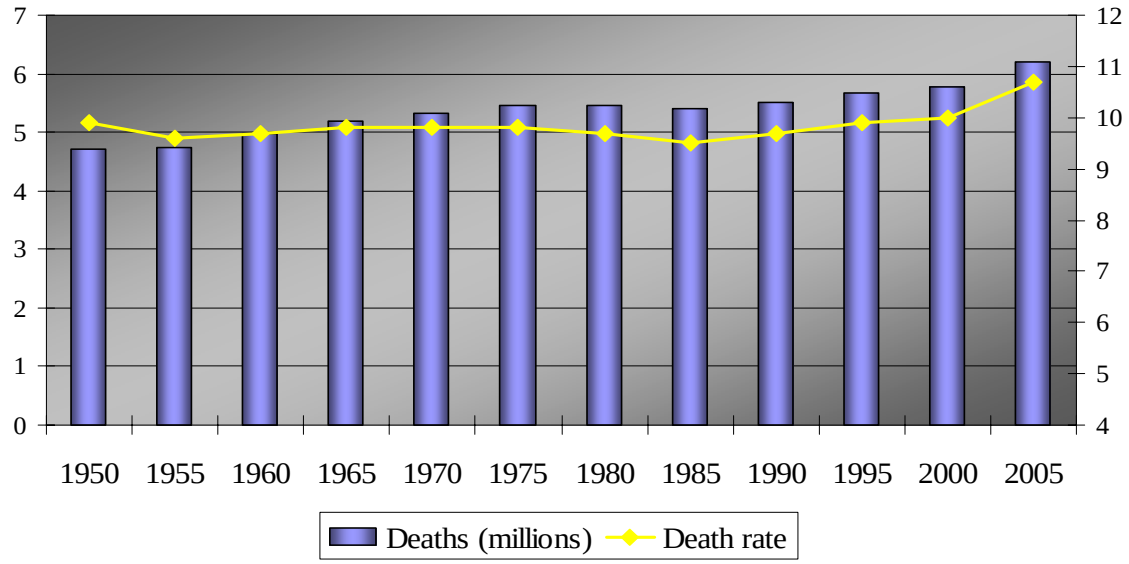
Chart 6: Total fertility rate in Italy, 1950-2005.



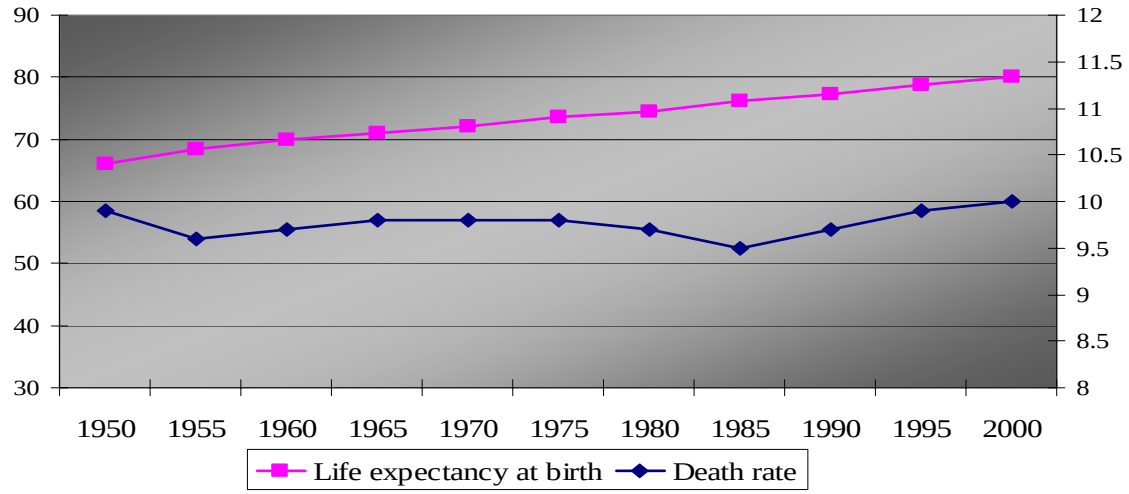
Data Source: Eurostat Demographic Database.

Chart 7: Absolute number of deaths and death rate in Italy, 1950-2005.



Data Source: Eurostat Demographic Database.

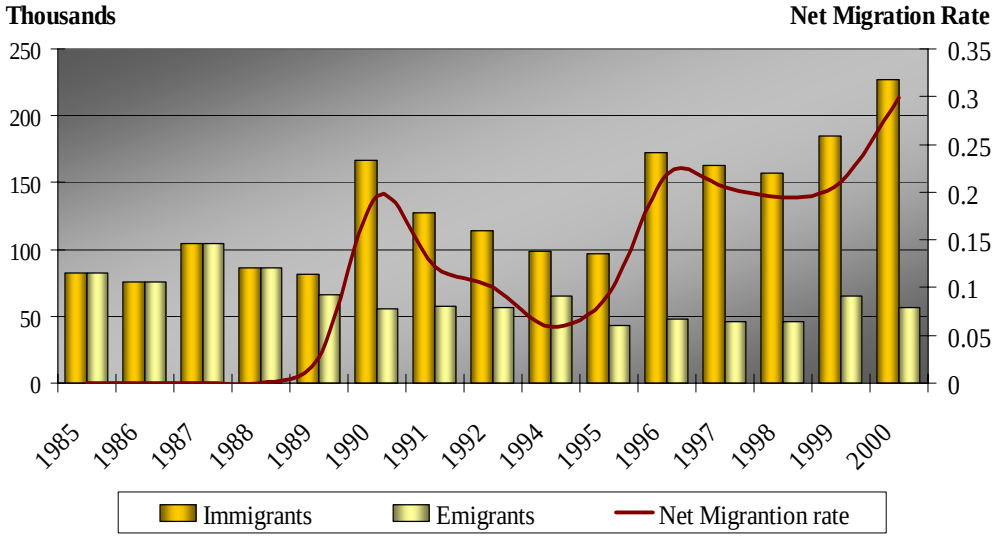
Chart 8: Life Expectancy and death rate in Italy, since 1950 to 2005.



Data Source: Eurostat Demographic Database.

Finally, the number of immigrants, the number of emigrants and the net migration rate over the period 1985-2000 are plotted in Chart 9. While the number of emigrants has remained almost unchanged, the number of immigrants has sensibly increased in the last 15-year period, reaching more than 200,000 units. As a result, net migration flows boosted from around zero in the late 1980s to more than 170,000 net migrants recorded in 2000. Similarly, net migration rate jumped from zero to 0.3.

Chart 9: Immigrants, emigrants and net migration rate in Italy, 1985-2000.



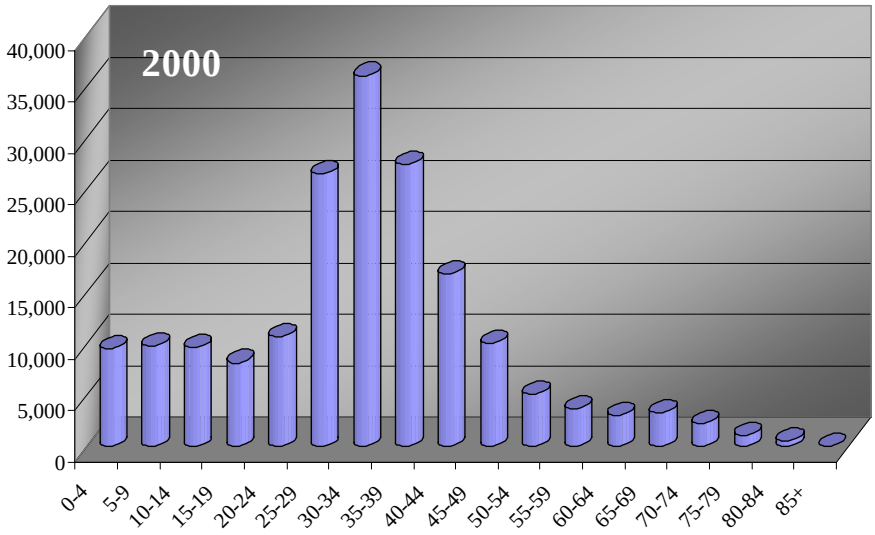
Note: values for immigrants and emigrants (columns) can be read on the left scale; those for the net migrants (line) on the right-hand-side one.
Data Source: Eurostat Demographic Database.

The distribution of immigrants and emigrants by 5-year age-group has been examined for each year of available data, i.e. from 1989 to 2000 included. However, since the distribution seems to remain unchanged across all years, in what follows we report only the results referred to the most recent data, i.e. 2000.

As reported in Chart 10, net migration typically occurs during working-age: in effect, in 2000 the most conspicuous group of net migrants was aged between 35 and 39 years, and more than 68,5% of all net migrants were between 25 and 50. According to this evidence, the increase in net migration flows recorded in Italy in the last years has mitigated the effects of population ageing by widening the working-age population.[5]

[5] The mitigating effect that an increased net migration has on population ageing is only temporary. As time goes by in fact immigrants grow older and join the domestic retired population. Additionally, evidence suggests that immigrating households tend to adapt their fertility choices to those of the destination country, thereby cancelling out the initial dampening effect on ageing. On this issue and specifically for Italian case see, among others, Martire and Zincato (2005) and reference therein.

Chart 10: Net migrants in Italy in 2000, by 5-year age-classes.



Data Source: Eurostat Demographic Database.

To sum up, in the last 50-year period (restricted to a 15-year period for migration) in Italy: net migration flows have sensibly increased, mortality has undergone only a small decline (death rate has increased but life expectancy has also considerably lengthened) and fertility has recorded a significant drop. Based on this evidence, the reduced fertility is thus recognised as the main determinant for the unique Italian population ageing.

4. Conclusions

The analyses performed in this paper on the phenomenon of ageing in Italy and its main causes point at two main conclusions, which provide an answer to the question in the title of this paper. First, that Italian population is undergoing the most pronounced ageing in the world after Japan. Second, when going deeper into the causes of such phenomenon it comes out that the drop in fertility is likely to be the major cause. In fact, although projections indicate lower mortality rates, the dynamics of the latter is significant but not as notable as that of fertility. The role of reduced fertility in determining the older age structure of the Italian population is further enhanced by the general finding of a higher net migration rate.

Finally, it has to be stressed that the use of two different databases makes conclusions robust in particular to different projection variants, a result which is apparent by the comparative analysis of the two databases provided in the Appendix.

These results may be useful to further researcher-work in various fields, since they have important social and economic consequences, which in turn have important policy implications. As an example, the most debated one in Italy is related to the pension system whereby projections for 2050 point towards the amazing picture of 75 retired every 100 working people. An interesting literature has been developing on these issues: see among others Baldini and Onofri (2001), Soede et al. (2004), Visco (2002, 2005).

However, many other related issues have not yet received enough attention especially for the case of Italy: specifically, the effects of ageing on household portfolios and hence ultimately on financial markets is investigated in a companion paper (see Brunetti and Torricelli, 2006).

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APPENDIX - Sources of Demographic Data

A.1 United Nations

In preparing the 2004 Revision of the official United Nations Population Prospect, the Population Division considered the most recent demographic data available for each country in the world. For developing countries the most recent demographic information can be found in surveys, such as the Demographic and Health Surveys Programme (DHS) since 1984 and the World Fertility Survey (WFS) programme prior to 1984, the Pan Arab Project for Child Development (PAPCHILD) of the League of Arab States, later continued as the Pan Arab Project for Family Health (PAPFAM), and the Gulf Family Health Survey (GFHS). During the 1990s, UNICEF embarked on a process of helping countries to make the condition of children progress. Since then, two rounds of Multiple Indicator Cluster Surveys have been carried out (MICS and MICS-2) that, among other things, collected and estimated information on infant and child mortality. Thus, also these surveys are included into the data sources of UN dataset. Finally, demographic information as produced by other United Nations agencies or bodies are also considered, such as those produced by the Economic and Social Commissions for Asia and the Pacific (ESCAP), for Latin America and the Caribbean (ECLAC/CELADE) and for Western Asia (ESCWA), as well as the United Nations High Commissioner for Refugees (UNHCR), the United Nations Children's Fund (UNICEF) and the World Health Organization (WHO). Data from regional organizations such as the Statistical Office of the European Communities (EUROSTAT) and the Council of Europe, the Institut National de la Statistique et des Études Économiques (INSEE) and the Centre d'Études et de Recherche sur la Population et le Développement (CERPOD), have also been consulted.

A.2 Eurostat

As far as Eurostat is concerned, demographic data are generally collected directly from the relevant national statistical institutes of each country. Since there is no international recommendation for demographic statistics, the data collected actually depend on the registration systems used in each country. As an example, the definitions of age used for the classification of events occurring in a given year might be two: the age reached during the calendar year, defined as the year of observation minus the year of birth, and the last birthday age, i.e. the age in full years.[6] As a consequence, Eurostat collects from each country raw numbers, rather than demographic measures, on which the relevant demographic indicators are then calculated. This procedure if on one hand improves the comparability of data (following the previous example, all events are

[6] A comprehensive analysis of the different systems used in 31 European countries for the collection of demographic data can be found in Eurostat (2003).

classified by the age reached during the calendar year), on the other it introduces discrepancies between some Eurostat demographic indicators and those published by the national statistical institutes of each country. Furthermore, Eurostat consults also other internationally acknowledged data sources, namely the Council of Europe, the United Nations and the US Bureau of the Census.

A.3 Projection Variants: Underlying Assumptions

A.3.1 United Nations

The United Nations Population Division elaborates projections for the future population up to 2050, by applying different assumptions regarding future trends in fertility, mortality and migration. Since future trends cannot be known in advance with certainty, a number of projection variants are produced. Table A1 presents the assumptions underlying the six projection variants included into the 2004 Revision of the UN Population Prospect : (i) constant-fertility, (ii) medium, (iii) low, (iv) high, (v) constant-mortality, and (iv) zero-migration, whereby (v) and (iv) are not available on the UN website as considered less likely for the future.

Table A1: UN Projection variants: underlying assumptions.

Projection variant	***Assumptions***		
	Fertility	***Mortality***	***Migration***
Constant-fertility	Constant	Normal	Normal
Medium	Medium	Normal	Normal
Low	Low	Normal	Normal
High	High	Normal	Normal
Constant-mortality	Medium	Constant	Normal
Zero-migration	Medium	Normal	Zero

Source: 2004 UN World Population Prospect

As far as mortality is concerned, two different assumptions are considered: (i) Constant, in which the mortality rate of each country remains constantly at the current level over the whole forecast period; and (ii) Normal, in which if the country is not affected by high incidence of HIV/AIDS, as it is the case for all developed countries, the mortality rate undergoes a slender and constant decline, otherwise is slightly rises. Nevertheless, in both cases the estimated changes in life expectancy are very small. Similarly, future paths of international migration are assumed to be either zero (zero assumption) or consistent with the levels recorded in the past (normal assumption).

On the other hand, four different levels are hypothesised for fertility rates: (i) Constant, (ii) Medium, (iii) Low and (iv) High. In the constant-fertility variant, the projections on future populations are based on the assumption that each country maintains the current level of fertility estimated for 2000-2005. In the Medium case, the total fertility for each country is estimated

according to a model, established by the United Nations Population Division and based on the past experience of countries, in which fertility rate converges toward a level of 1.85 children per woman. This level is a "floor value", since if the model predicts a total fertility higher than 1.85 children per woman then the fertility rate produced by the model is used, otherwise the minimum value of 1.85 is maintained for the remainder of the projection period, i.e. until 2050. In the Low variant, fertility is projected to remain 0.5 children below the rate set in the Medium variant, so that those countries for which the model predicts a total fertility rate of less than 1.85 children per woman in the Medium variant, can reach here a total fertility rate of 1.35 children per woman. Finally, the last level hypothesised for fertility, i.e. High, assumes the total fertility rate to of 0.5 children higher than that estimated in the Medium variant, so that those countries that in the medium variant reached the floor value of 1.85, have here a minimum total fertility rate of 2.35 children per woman.

A.3.2 Eurostat

Eurostat produces its projections for future population by taking a very similar approach to UN. In fact, the seven variants produced, i.e. (i) baseline, (ii) high-population, (iii) low-population, (iv) younger age profile, (v) older age profile, (vi) high fertility and (vii) zero migration, are obtained by combining three different levels of fertility rate, life expectancy and migration flows: Base, High and Low (see Table A2). However, in contrast to UN, the levels assumed for fertility, mortality and net migration are not homogenous across countries. In fact, although producing population projections up to 2051 for each member state plus two candidate countries (Bulgaria and Romania) that are internationally comparable, the three levels of each underlying assumption are set in order to match as closely as possible the specific experience for each country.[7]

Table A2: Eurostat Projection variants: underlying assumptions.

Projection Variant	***Assumptions***		
	Fertility	***Life Expectancy***	***Migration***
Baseline	Base	Base	Base
High Population	High	High	High
Low Population	Low	Low	Low
Younger Age Population	High	Low	High
Older Age Population	Low	High	Low
High Fertility	High	Base	Base
Zero Migration	Base	Base	Zero

[7] The full dataset of underlying assumptions referred to each European country are available on the Eurostat website, at http://epp.eurostat.cec.eu.int .

Since a comprehensive analysis of the assumptions imposed for each European country goes beyond the aim of this work, the values assumed for each factor for the European Union are summed up in Table A3, whereas Italy is described by Charts A1-A3. It emerges that in many cases, the values assumed for Italy are even more striking than that for EU25. As an example, total fertility rates are expected to tend to values which are sensibly lower than the EU25 averages whilst both male and female life expectancy at birth are on average a couple of years higher than the values reported for EU25. More specifically, Chart A1 highlights that the initial value of total fertility rate is around 1.3 children per woman and that in the High-level scenarios it is assumed to gradually increase until 2021 and to stabilize thereafter around 1.7. Under the Base hypothesis it slowly increases up to 1.4 whilst in the Low-level scenarios it slightly decreases, reaching the level of 1.2.

Table A3: Eurostat underlying assumptions: values for EU25 and Italy.

Demographic indicators	Year	EU25			Italy		
		High	***Base***	***Low***	***High***	***Base***	***Low***
Total fertility rate	2005	1.44	1.44	1.44	1.34	1.31	1.27
	2010	1.63	1.51	1.38	1.49	1.37	1.24
	2020	1.81	1.59	1.39	1.67	1.4	1.21
	2030	1.89	1.60	1.39	1.7	1.4	1.2
	2050	1.90	1.60	1.40	1.7	1.4	1.2
Life Expectancy	2005	78.75	78.75	78.75	80.45	80.25	80.25
	2010	79.95	79.4	79.05	81.55	81.1	81
	2020	82.05	80.5	80.25	83.7	82.65	82.4
	2030	84	82.75	81.7	85.4	84.05	83.45
	2050	86.35	84	82.75	87.5	86.1	84.95
Net Migration Flows	2005	2,000,000	2,000,000	2,000,000	366,833	329,951	312,900
	2010	1,100,000	900,000	500,000	155,465	118,467	102,632
	2020	1,100,000	710,000	400,000	156,065	118,533	100,032
	2030	1,400,000	900,000	400,000	154,265	113,800	84,182
	2050	1,400,000	900,000	400,000	154,365	113,800	75,232

Notes: a) Data Source: Eurostat

b) total fertility rate is the average number of children to each woman;

c) life expectancy is the average of male and female expectations of life at birth, in years.

As for life expectancy (the average between male and female life expectancy), it is expected to increase in all scenarios: from the current level of around 80 years up to 90 under the High-level scenarios, to slightly more than 86 under the Base assumption and around 85 under the Low-lever scenarios, as reported in Chart A2.

Chart A11: Italian total fertility rate under the Eurostat underlying assumption.

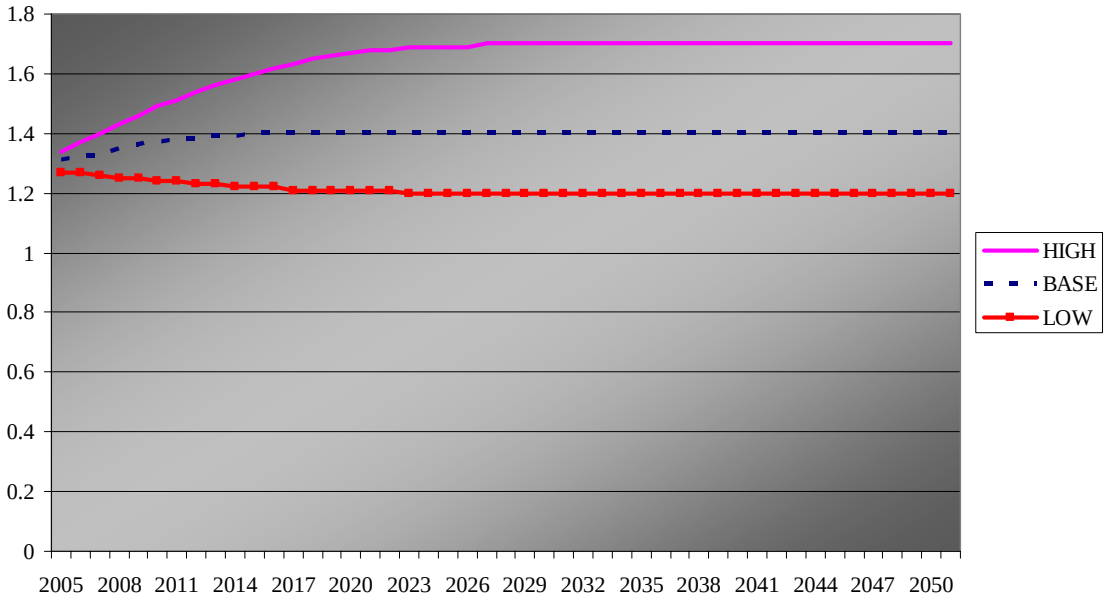
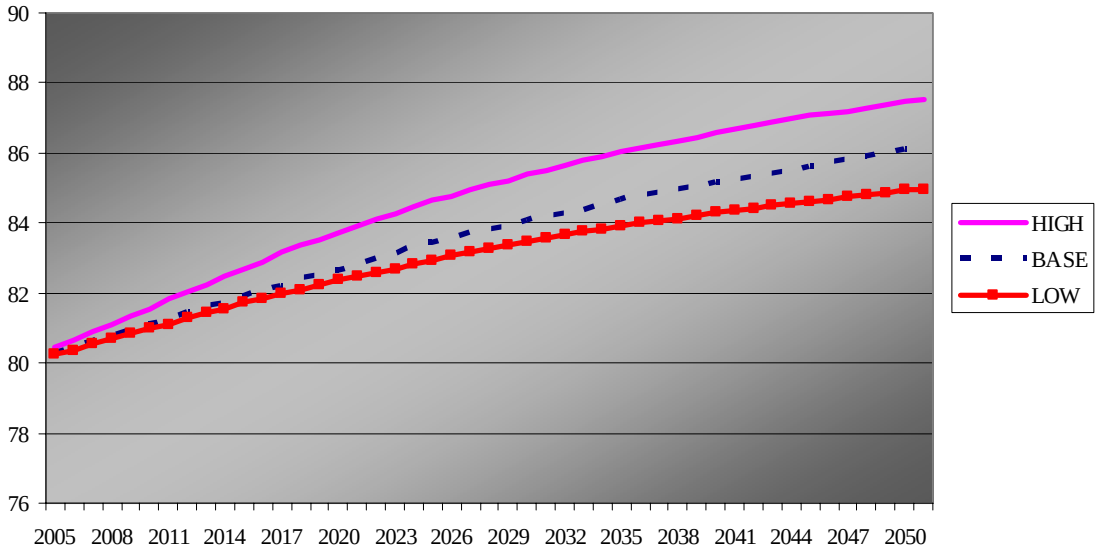


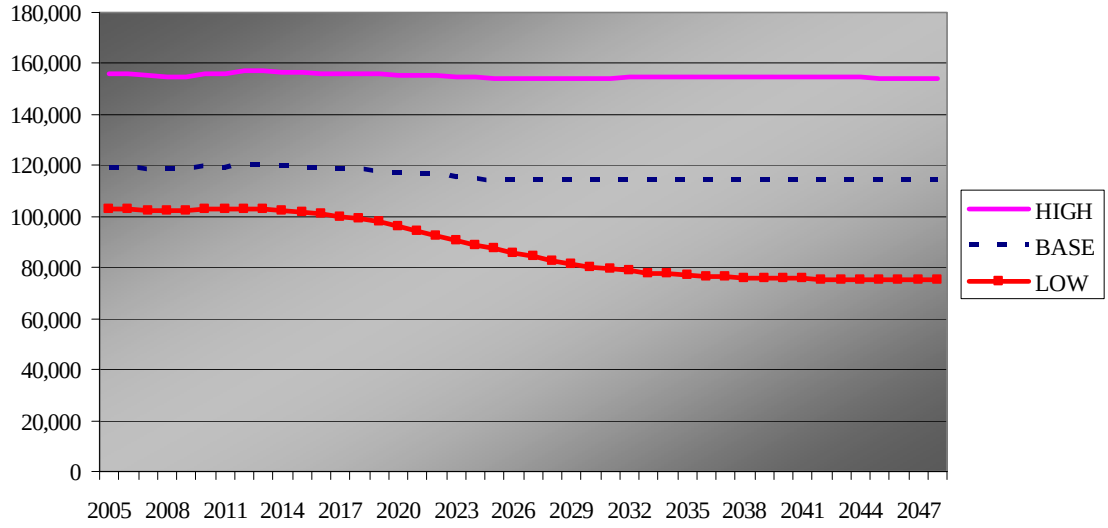
Chart A2: Italian life expectancy under the Eurostat underlying assumption..



Finally, assumptions on migration flows are plotted in Chart A3. Net migration flows are assumed to remain constantly around 160.000 in the High hypothesis and to gradually reduce from around 120.000 to 114.000 in the Base assumption. On the other hand, the Low assumption projects

net migration to remain constantly around 100.000 migrants until 2019 and then to reduce to around 75.000 by 2051.

Chart A3: Italian net migration flows under the Eurostat underlying assumption..



A.4 Projection Variants: comparisons within and between datasets

After a comparison of variants within each dataset in Section A.4.3 the most comparable variants of each dataset are confronted with the aim to investigate the robustness of the projections to the different underlying hypotheses imposed to generate them.

A.4.1 Within United Nations

The four available projection variants produced by UN lead to forecasts on the total Italian population quite different, which range from 44,344 millions forecasted in the Low variant to the 58,382 millions projected under the High variant (see Chart A4). Charts A5-A7 plot the projected number of individuals in the 3 main age-categories, namely young (0-14), middle-aged (15-64) and old (65 or over) for the next 50-year period.

Clearly, the uncertainty, i.e. the discrepancies among the projections, reduces when moving from young, to middle-aged and old population. In fact, the forecasts for young population progressively depart from each other, while the four variants are much closer to each other all over the entire horizon if referred to middle-aged people (see Chart A6).

Chart A4: Projected total Italian population: UN variants.

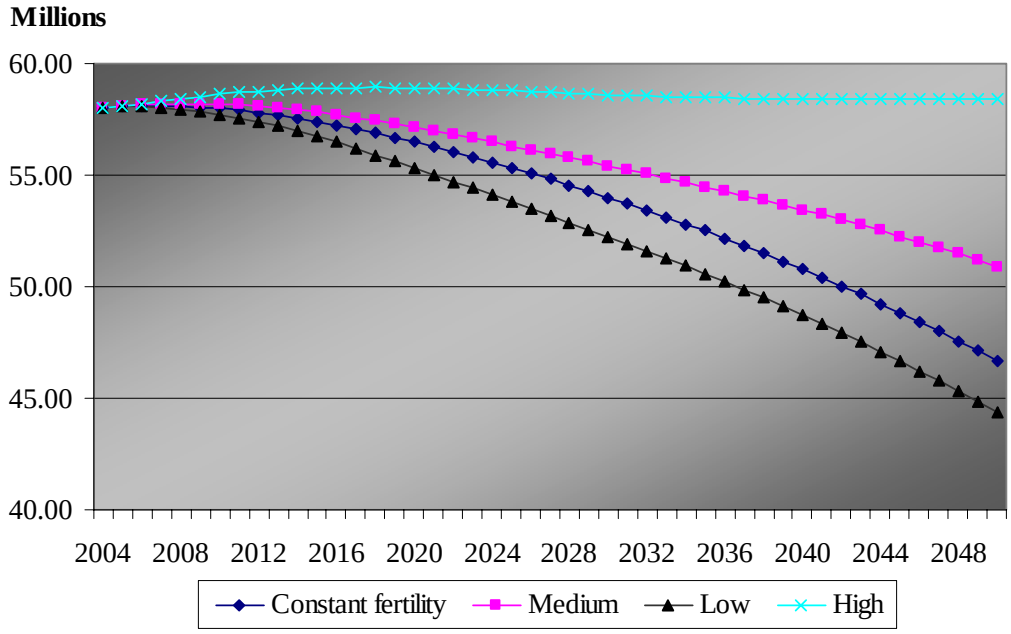


Chart A5: Projected young Italian population: UN variants.

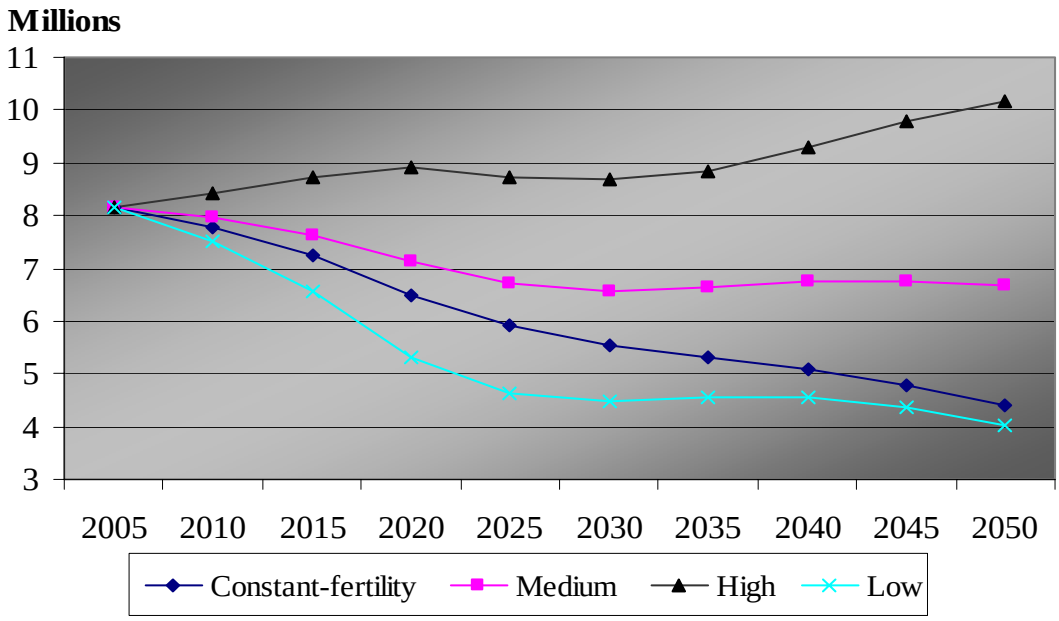


Chart A6: Projected middle-aged Italian population: UN variants.

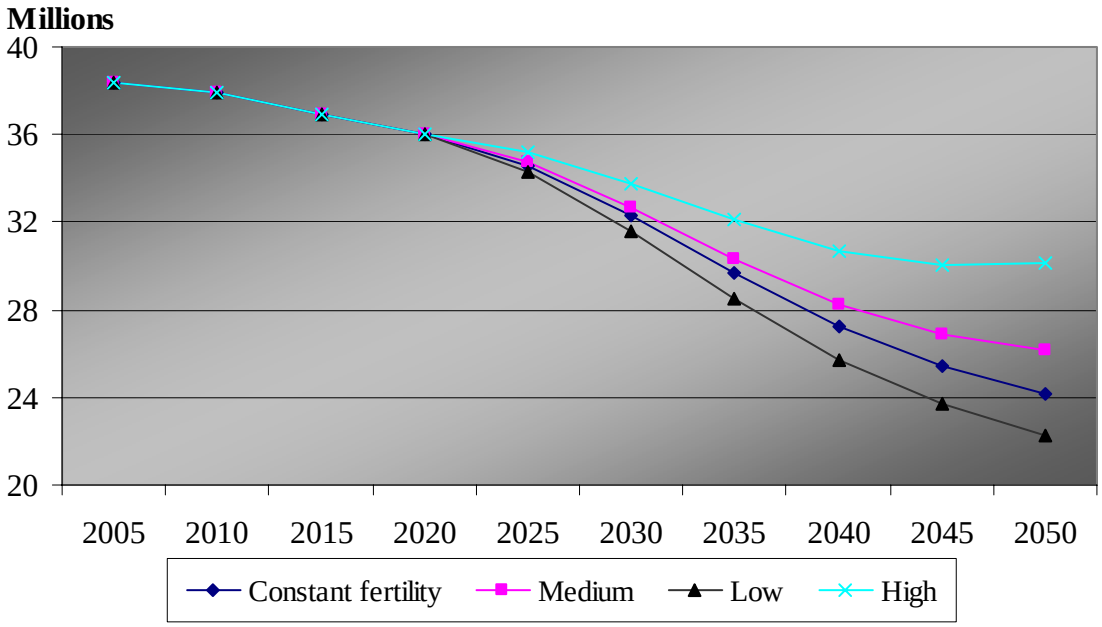
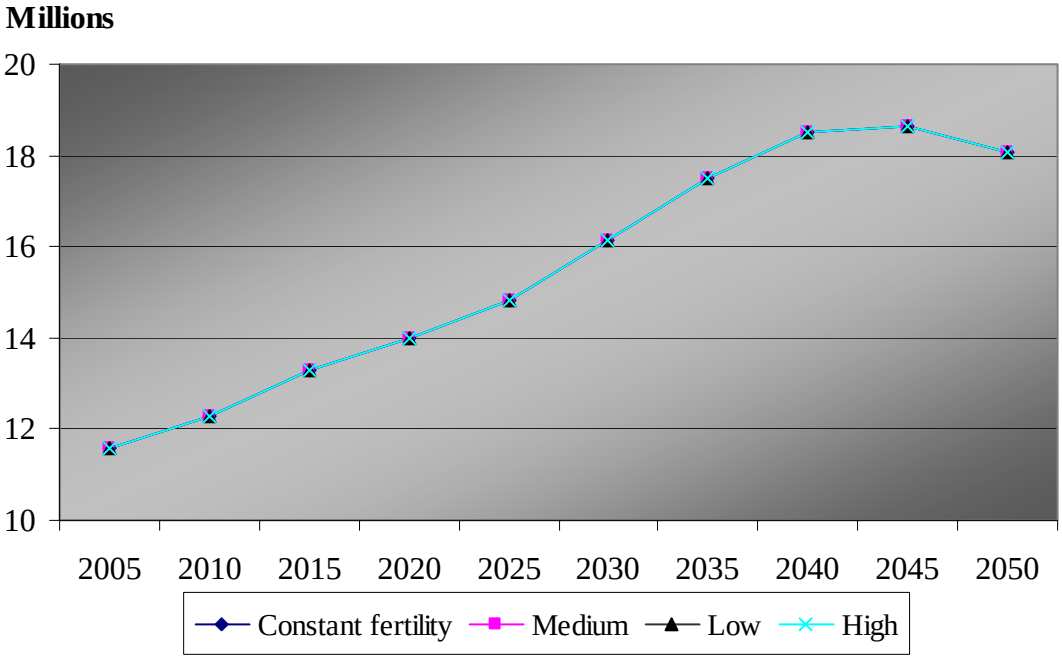


Chart A7: Projected old Italian population: UN variants.



Finally, as for the older part of the population, the four projection variants display no discrepancy at all over the entire forecast horizon. In effect, in all variants the number of retired individuals is expected to increase by 2045 from the current 12 millions to almost 19 millions. This progressively reduced discrepancies among the four projection variants stem from the fact that the old population of tomorrow is the young population of today, which is already known. Conversely,

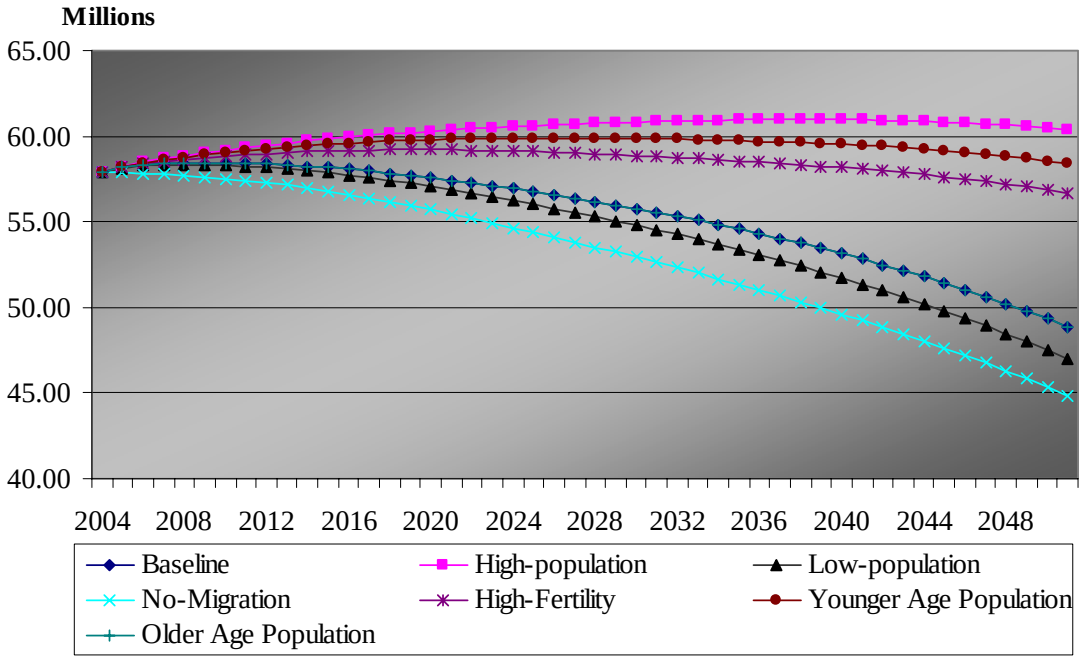
forecasts on future number of young are much more different with each other as they totally depend on the assumptions made on future level of fertility, on which there is no certainty at all.

A.4.2 Within Eurostat

Also the variants produced by Eurostat suggest different levels of future Italian population. In particular, while 4 of the projection variants, namely no migration, low-population, older age and baseline, point towards a strong decline in total population, the remaining three, i.e. high-population, younger-age and high-fertility seem to point towards an overall constant population (see Chart A8).

As for the young population projections, although each variant produces slightly different results, the seven variants clearly can be divided in two groups: the former includes High-population, Younger Age population and High-fertility variants and forecasts that the number of young will remain relatively constant around 8 millions; the latter includes No-Migration, Older-Age population, Low-population and the Baseline variants and predicts that by 2050 young people will sharply reduce to slightly more than 4 millions.

Chart A8: Projected total Italian population: Eurostat variants.



A relevant discrepancy is also apparent between projection variants on the future number of middle-aged; nevertheless they all point to a decline in the number of middle-aged starting from 2025, consistently with the above reported UN projections.

Chart A9: Projected young Italian population: Eurostat variants.

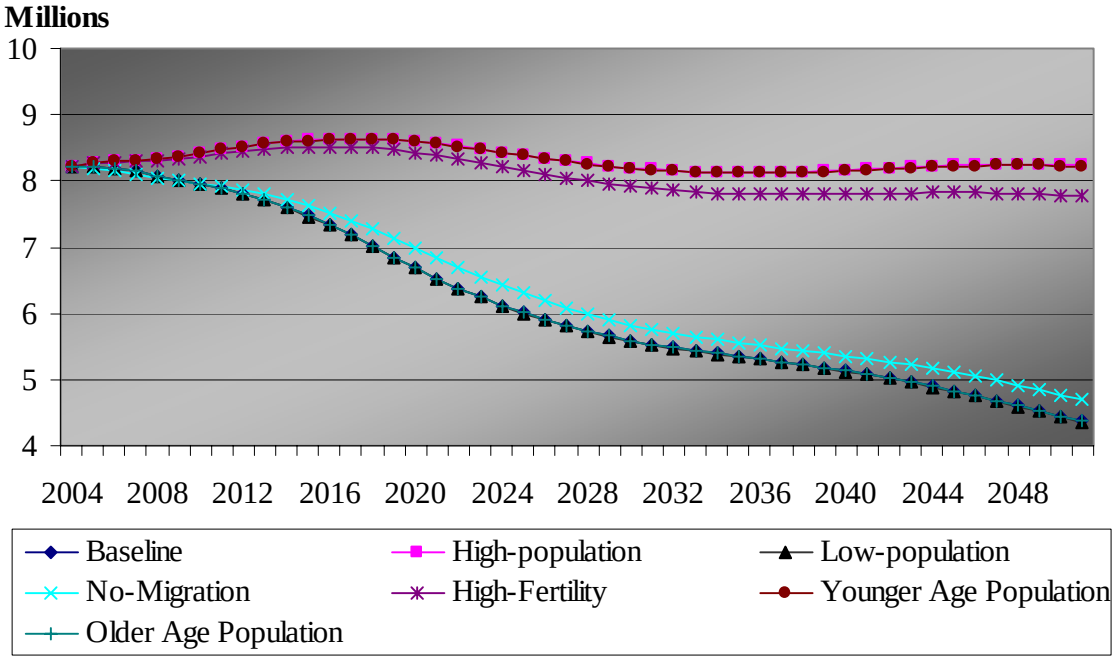


Chart A10: Projected middle-aged Italian population: Eurostat variants.

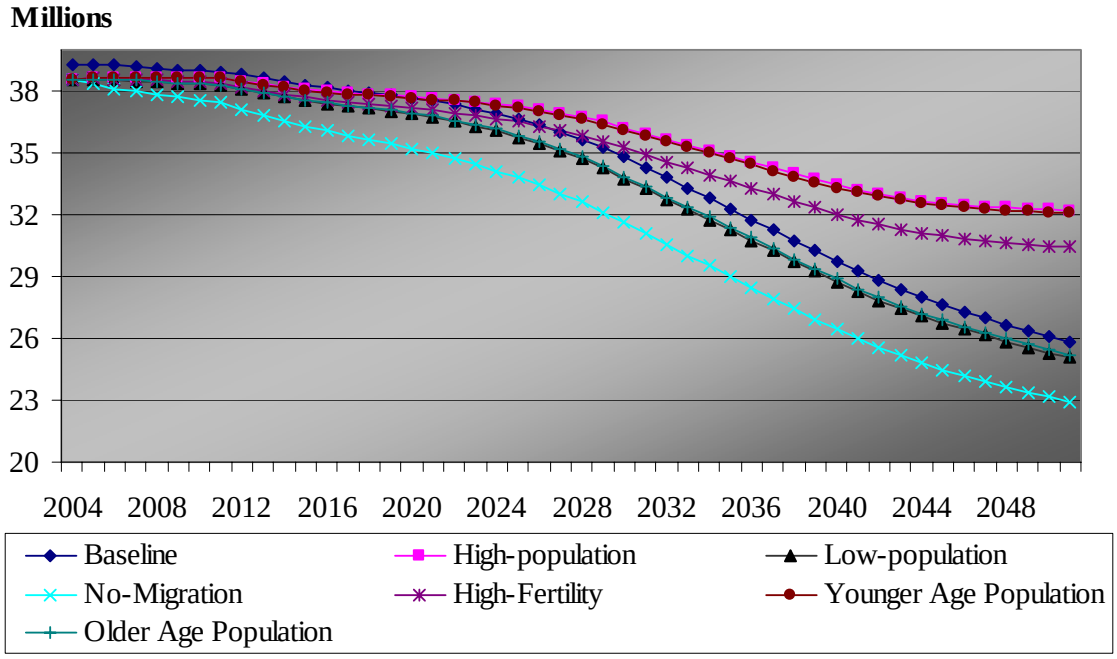
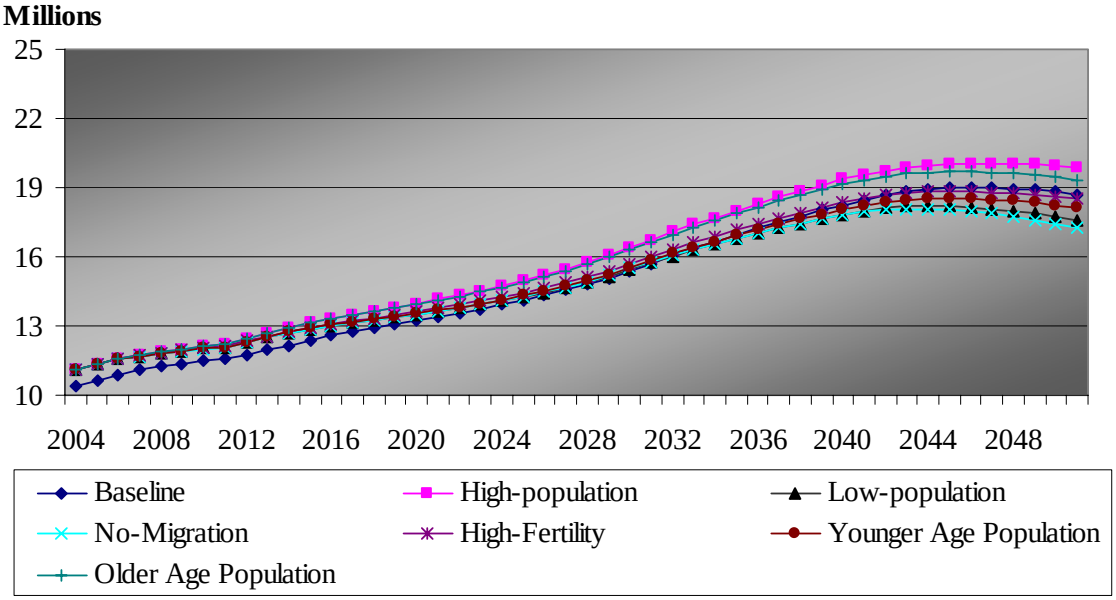


Chart A11: Projected old Italian population: Eurostat variants.



Finally, as in the UN projections, the smallest degree of discrepancy among Eurostat estimations is shown by the projections for the old part of the population. In effect, all variants suggest exactly the same evolution over the forecast horizon and for 2050 predict very similar values, between 18 and 20 millions: a range much smaller than those seen above for middle-aged and young.

A.4.3 Between United Nations and Eurostat

The most comparable variants of each dataset are compared with each other (see Table A4) in order to investigate the robustness of the projections to the different underlying hypotheses imposed to generate them.

Table A4: UN and Eurostat most comparable projection variants.

United Nations	*Eurostat*
Constant-fertility	Baseline
High	High-Fertility
Medium	Younger-Age Population
Low	Older-Age Population

In particular, UN Constant-fertility variant is coupled with Eurostat Baseline variant. In both cases in fact fertility is assumed constant at the 2000-2005 values until the end of the forecast period, in 2050; as for mortality, UN projections assumed a slightly declining mortality rate, consistently with the slightly increasing life expectancy imposed in the Eurostat projections; finally, in both cases net migration flows are maintained almost unchanged with respect to the levels

recorded in 2005. Similarly, UN High projection variant is coupled with Eurostat High-Fertility variant, as both impose the highest level of fertility rate whilst keeping the current levels for both mortality and net migration flows. The two remaining couples, i.e. UN Medium and Low variants respectively matched up with Eurostat Younger-Age population and Older-Age population variants, are basically formed on the basis of the sole hypothesis on fertility rate, as the underlying assumptions on mortality and net migration are not directly comparable. Yet, as for the former, the assumptions are in any case consistent: for countries in which HIV/AIDS is not widespread UN imposes a slight decline in mortality rate, which is coherent with the slightly increasing average life expectancy entailed instead by Eurostat projections. As for net migration, on the other hand, it must be recalled that, at least in the last 50-year period, it has had an effect on total population which could be considered in the end negligible[8]: as a result, the presumptions on this factor are less decisive for future population projections and the couples can be reasonably formed even if the underlying assumptions made by the two data sources on net migration flows are not effectively comparable. Thus, UN medium variant is coupled with Eurostat Younger-Age population variant as the assumed fertility rate tend to very similar values, namely 1.85 in UN projections and 1.7 in Eurostat ones, and UN Low variant is associated to Eurostat Older-Age population variant, as both impose the lowest fertility rate possible. For each of these couple, the projections produced for Italy are compared. In particular, the comparison is performed both on total population forecasts as well as on projections for the three main age-groups, i.e. young, middle-aged and old, in order to check whether the estimations not only suggest comparable amount of population but also consistent age-class distribution (see Charts A12 – A15 and Table A5).

A few observations are here in order. First, all compared variants suggest consistent patterns also at very long horizons (i.e. 2030 – 2050), when the uncertainty about future population clearly counts more. Second, as for total population projections two couples out of four match almost perfectly, namely UN Constant-fertility and Eurostat Baseline and UN High and Eurostat High-Fertility. The two remaining couples on the other hand display some differences in particular, in the UN Medium vs Eurostat Younger-Age population comparison, Eurostat seems to overstate the reduction of total population, whilst the opposite occurs when UN Low variant and the Eurostat Older-Age population variant are compared. Third, turning to the three main age-classes forecasts, the same progressive reduction of the degree of uncertainty among projections is observed: the major discrepancies occur when the forecasts refer to young share of the population, whilst almost completely disappear when referred to the elderly part of the population. In fact, even if the projected number of future young and middle-aged are very similar across all compared variants,

[8] See, among others, Bloom and Canning (2004) and the results reported at the end of Section 3.

the number of old individuals is the one on which variants and databases seem to agree the most: by 2050 there will be around 18 millions retired.

Chart A12: UN constant-fertility and Eurostat baseline: Italian projections compared.

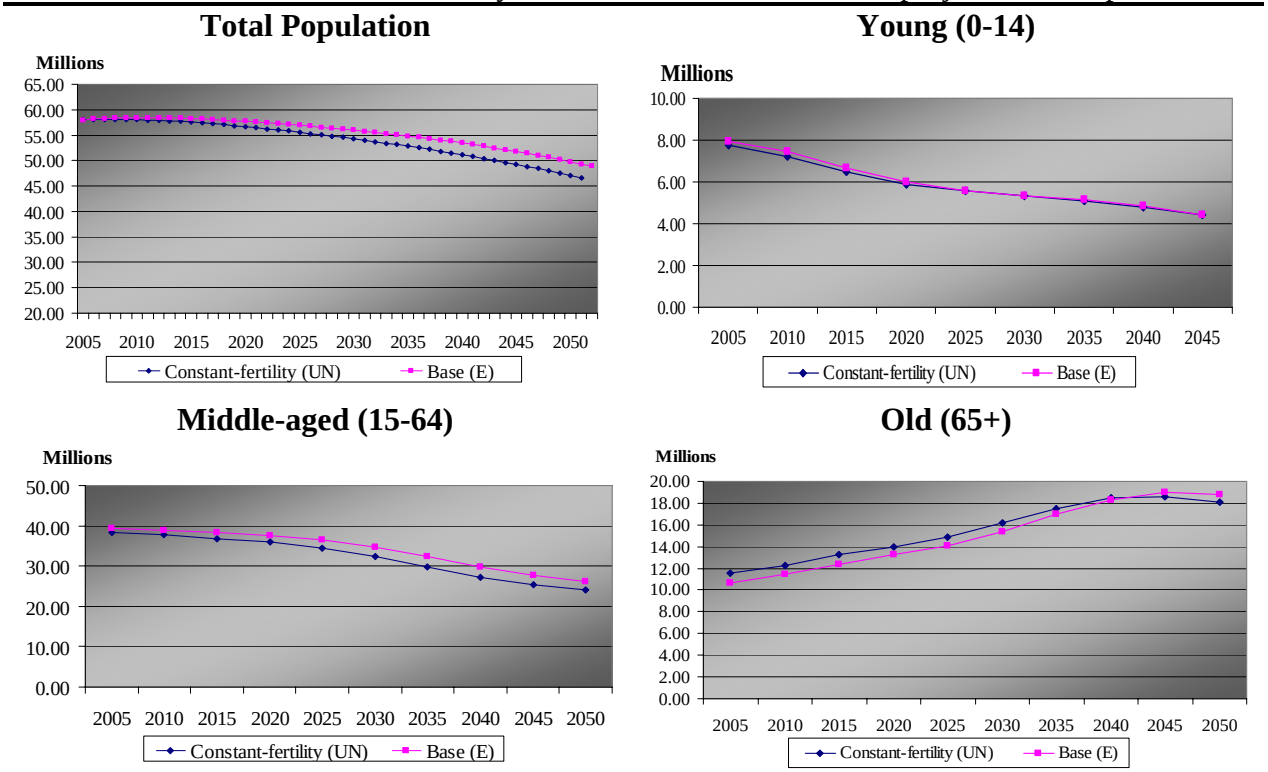


Chart A13: UN medium and Eurostat Younger-Age population: Italian projections compared.

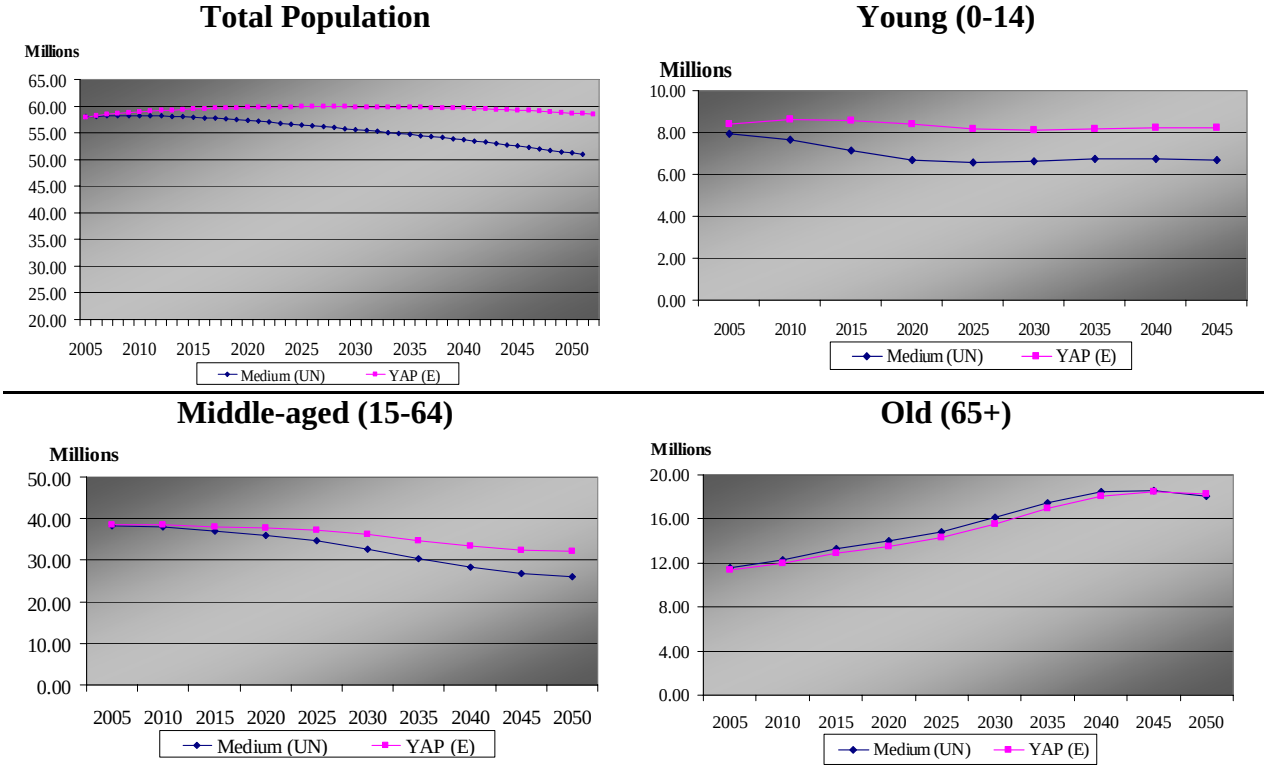
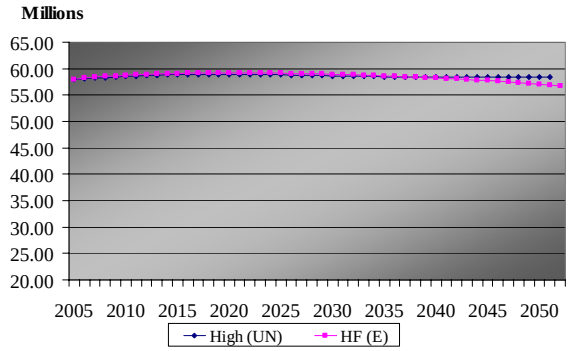
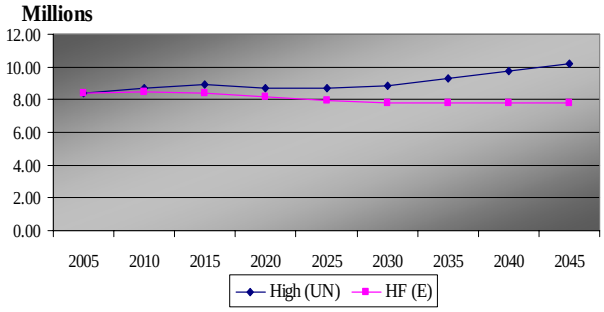


Chart A14: UN High and Eurostat High-Fertility: Italian projections compared.

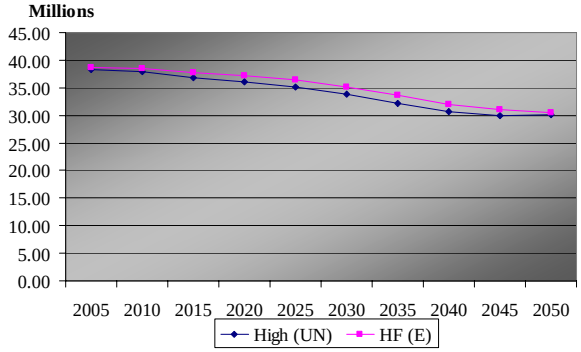
Total Population



Young (0-14)



Middle-aged (15-64)



Old (65+)

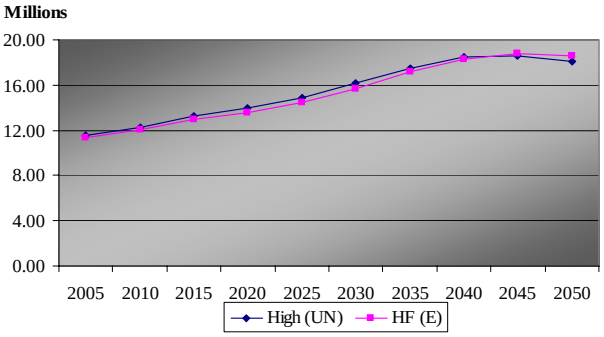
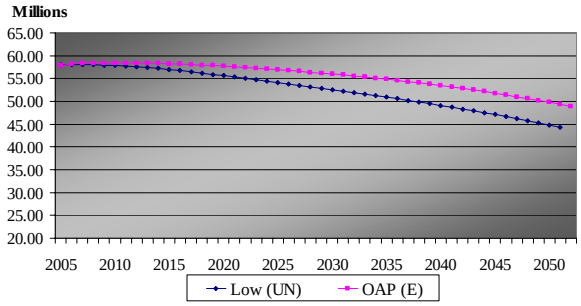
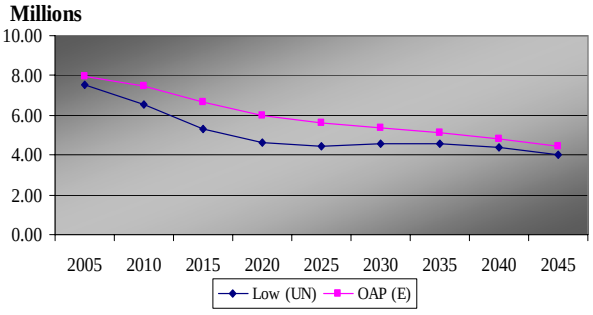


Chart A15: UN Low and Eurostat Older-Age population: Italian projections compared

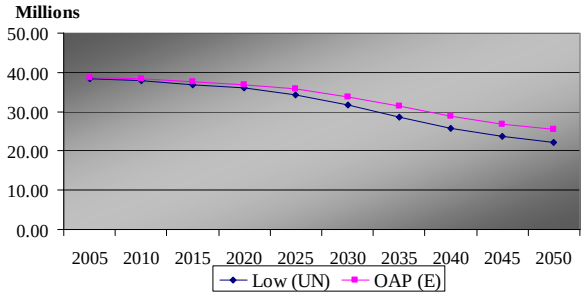
Total Population



Young (0-14)



Middle-aged (15-64)



Old (65+)

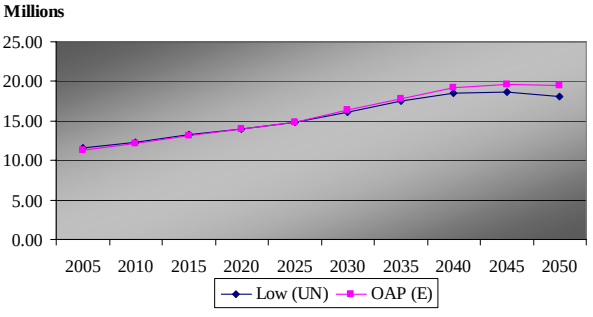


Table A5: UN and Eurostat projection variants: total and age-classes population.

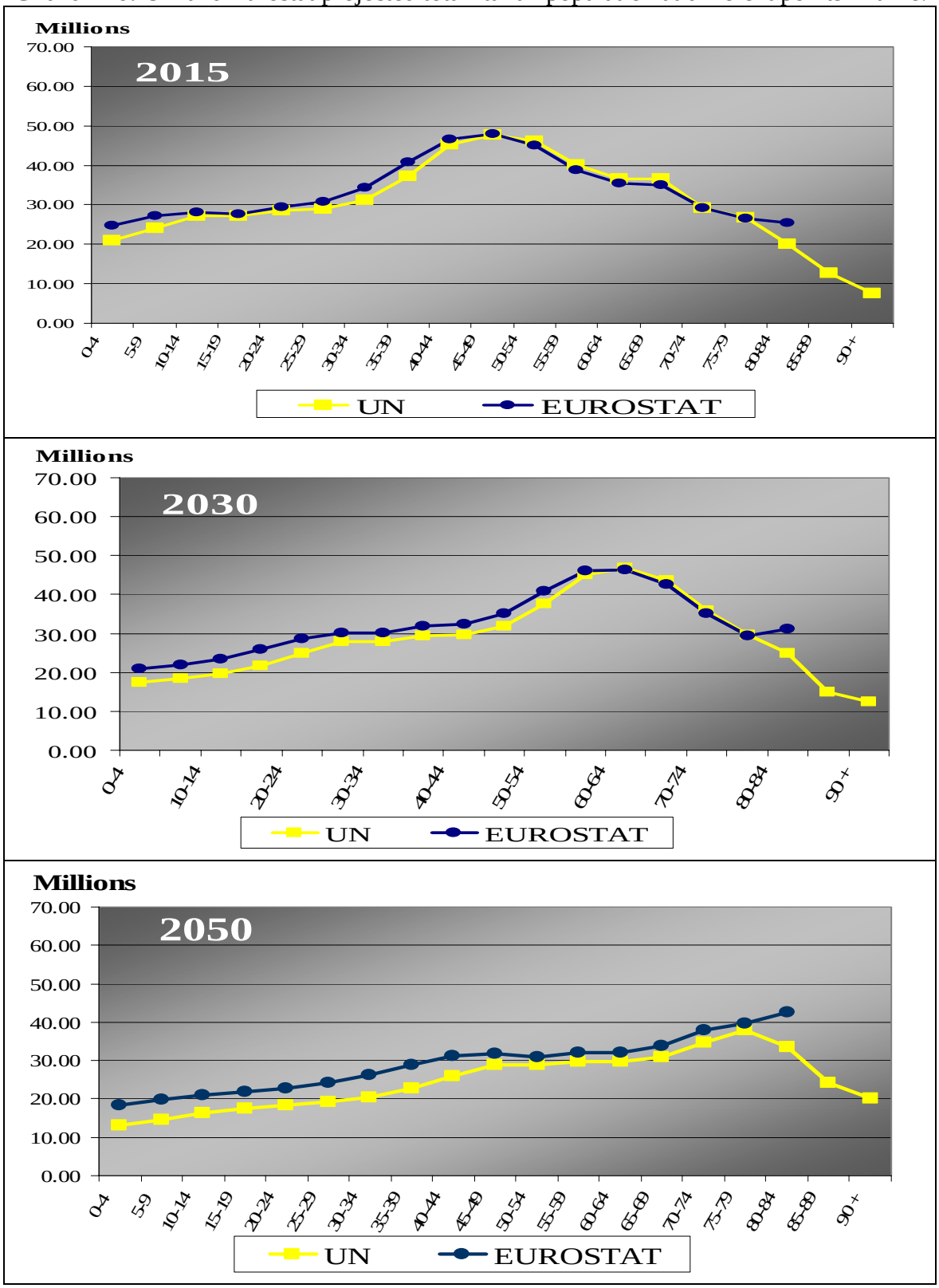
		United Nations				Eurostat			
		CF	*H*	*M*	*L*	*B*	*HF*	*YAP*	*OAP*
Total Population	***2005***	58,09	58,09	58,09	58,09	58,17	58,20	58,24	58,17
	2025	55,31	58,78	56,31	53,80	56,76	59,09	59,88	56,76
	2050	46,67	58,38	50,91	44,34	49,34	56,86	58,57	49,34
Young	***2005***	7,78	8,41	7,97	7,51	7,96	8,37	8,42	7,96
	2025	5,90	8,73	6,71	4,65	6,01	8,16	8,38	6,01
	2050	4,42	10,18	6,68	4,02	4,45	7,78	8,23	4,45
Middle-aged	***2005***	38,35	38,35	38,35	38,35	39,29	38,60	38,63	38,59
	2025	34,57	35,21	34,76	34,31	36,64	36,51	37,18	35,85
	2050	24,16	30,12	26,14	22,24	26,08	30,47	32,11	25,43
Old	***2005***	11,60	11,60	11,60	11,60	10,65	11,34	11,34	11,35
	2025	14,84	14,84	14,84	14,84	14,11	14,43	14,31	14,90
	2050	18,09	18,09	18,09	18,09	18,81	18,60	18,23	19,46

Notes: a) values are expressed in millions
b) CF = Constant-fertility, H = High, M = Medium, L = Low, B = Baseline, HF = High-Fertility, YAP = Younger-Age Population, OAP = Older-Age Population.

The consistency between UN and Eurostat population forecasts is examined more in detail by comparing the projected distribution of the population by 5-year age-classes of the two most likely variants, namely Constant-fertility for UN and Baseline for Eurostat, at three different points in time (see Chart A16). The two variants seem to point to an almost identical population distribution, also at a 25-year time horizon.

To sum up, all variants based on similar assumptions suggest very similar evolution for the future Italian population. In addition, the variant considered most likely in each database, i.e. UN Constant-fertility and Eurostat Baseline, seem to match very well, not only at aggregate levels (i.e. for the entire total population and for the three main age-classes) but also when the study is carried out in more in depth by considering 5-year age-classes.

Chart A16: UN and Eurostat projected total Italian population at different points in time.



Note: UN projections consider 5-year age classes: from 0-4, … to 75-79, 80-84, 85-89 and 90 and above. Eurostat on the other hand join together all individuals aged 80 and above. As a consequence, the last Eurostat observation is always higher than the last three UN observations.