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Survival inequalities and redistribution in the Italian pension system

Graziella Caselli and Rosa Maria Lipsi*

Abstract

The public pension system in Italy is a defined contribution scheme based on the principle of actuarial fairness. The pension annuity is calculated starting from capitalised value and the *Legislated Conversion Factors* (LCFs) for each retirement age. The demographic parameters used by legislators in computing the LCFs are the survival probabilities of an average Italian, irrespective of gender or any characteristic except age. The aim of this paper is to analyse the impact of the differences in survival between men and women, and between individuals with different educational levels, on the calculation of the pension annuity, starting from the specific *Conversion Factors* (CFs). The gap between the LCFs and the factors obtained by allowing for differential survival across gender and socio-demographic groups (CFs) gives us a means of making a quantitative assessment of the implicit redistributive impacts of the annuity redistribution from individuals with a lower life expectancy to individuals with a higher life expectancy.

1 Italian pension reform: an introduction

Since the mid-1970s, the demographic behaviour of Italians has undergone profound changes that have modified the population dynamics of the country both directly and indirectly, and have thus had significant consequences for various aspects of social and economic life in Italy. The slow but inexorable shift in the demographic profile of Italy has been caused by declining fertility on the one hand, and increasing survival on the other. It is generally understood that when the

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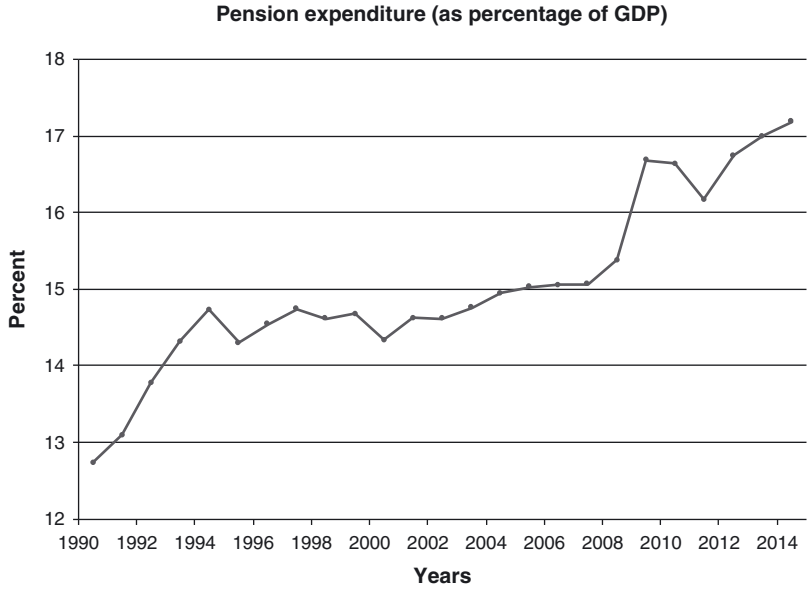
younger cohorts are constantly shrinking even as the older cohorts are expanding, the population will age. In 2016, Italy and Germany were the European countries with the highest shares of the population aged 65 or older: 21.9 per cent for Italy and 21.2 per cent for Germany. This figure for Italy seems even more significant if we consider that it represents a population of almost 14 million, up from four million in 1951 (eight per cent of the total population).

Although demographers had been issuing detailed warnings of this demographic shift since the late 1970s (Vitali 1976; Golini and Pinnelli 1983; Golini 1987), politicians were slow to realise that given the speed at which the ageing process was advancing, this shift would have an unprecedented impact on the country's public expenditures starting around the turn of the century. It was especially difficult to persuade politicians to pay attention to pension expenditures in the years when the combined effects of the growth of the population of working ages (due to the post-war baby boom that continued into the early 1960s) and high employment levels were pouring an unprecedented surplus into the coffers of the pension system. For many years, the retirement age and the pay-as-you-go system were not a problem – indeed, the revenue generated by this system could easily cover expenditures on welfare as well. When the first worrying signs of a rapid increase in pension expenditures began to appear in the 1990s, there was still no sense of urgency among policy-makers. While some minor adjustments to the retirement system were made, more drastic interventions would be required in the future. At that time, the retirement age was raised, early retirement pensions were scaled back (early retirement was still possible for workers with 35 years of contributions, and as little as 20 in the public sector), and years of contributions were tied more closely to pension size. From 1995 onwards, a new method of calculating pension benefits – a 'contribution system' that we describe in detail in this paper – was phased in (with the *'1995 Dini reform'*: Law of 8 August 1995, No. 335 (Table A.1, Appendix)). This system will go into full effect in 2030-35, when the baby boom generations born in the 1960s will have left the work force and become pensioners themselves.

It is becoming increasingly clear that the implementation of this reform has been too gradual. While additional legislative measures aimed at reforming the retirement system were approved in 2011, pension expenditures have continued to grow at an unsustainable rate, triggering the need for a further series of pension reforms (Figure 1).

Law Decree No. 201/2011 (known as the 2011 '*salva Italia*' decree), which included the '*2011 Fornero reform*' (Table A.1, Appendix), made two important changes to the retirement system. The decree brought the implementation of the *'1995 Dini reform'* forward many years by introducing a pro-rata contribution system for all workers starting on 1 January 2012. The legislation also raised the minimum retirement age to 66 for men; and from age 60 to age 62 for employed women, followed by a phase-in period to age 66 by 2018 (64 in 2014, 65 in 2016, and 66 in 2018). The minimum retirement age for self-employed women was set one year higher (65 in 2014, 66 in 2016, and 67 in 2018). The law also introduced a flexible retirement band that allows individuals who choose to work beyond the

Figure 1:
Italian pension expenditures as a percentage of gross domestic product (GDP) from 1990 to 2014



Source: Own elaboration on Istat data (Istat 2016c).

minimum retirement age to earn a larger pension. This band spans ages 63-70 for women and ages 66–70 for men.

The most important stages of the Italian pension reform from 1995 to 2016 are summarised in Appendix Table A.1. Examining these stages will help us better understand the impact the modifications of the retirement age have had on the calculation of the pension annuity, which currently affects millions of men and women in Italy, and will affect even more in the future. Survival probabilities at retirement age are used in calculating the *Legislated Conversion Factors* (LCF*s*), which were introduced by the *'1995 Dini reform'*. The LCFs were supposed to be updated every 10 years to take into account the dynamics of survival in old age. Obviously, if the gap between these updates is too long, the LCFs will fail to reflect the changes in length of life at these ages (Ediev 2014). For this reason, the most recent reform requires that the LCF*s* are updated every three years from 2013 to 2018, and every two years from 2019 onwards (Law Decree No. 201/2011 – Table A.1, Appendix).

The *'1995 Dini reform'* was based on the principle of *'actuarial fairness on average'*, which is only guaranteed in the LCFs *'on average'*, without distinguishing between different categories of workers or between men and women. This principle links the contributions and benefits of future pensioners at the age of retirement to

the present value of their contributions (or the value of their retirement wealth), which should equal the expected present value of the benefit stream. Because the survival probabilities used by legislators are, broadly speaking, those of an average Italian (irrespective of gender or any other characteristic except age), the contributions of a given individual may exceed (or fall short of) the benefits received if the person's life span is below (above) average. Yet we would argue that no analysis of the links between survival, ageing, and pension expenditures (and, more generally, welfare expenditures) can afford to ignore the differential aspects of the demographic process, as survival varies by gender, social class, and educational level (Caselli et al. 2003; Lipsi and Tomassini 2009; Luy et al. 2011). Thus, to properly evaluate the redistributive effects of social security and health care policies, it is essential that we study the differential aspects of survival (Bommier et al. 2011; Donnelly 2015; Pestieau and Ponthiere 2016; Piggott et al. 2005; Sanchez-Romero and Prskawetz 2017).

The aim of this paper is to analyse the impact of the differences in survival between men and women, and between individuals with different educational levels (Table A.2, Appendix), on the calculation of the pension annuity. The gap between the conventional LCF*s* and the LCFs obtained by allowing for differential survival across socio-demographic groups (CFs) provides us with a starting point for making a quantitative assessment of the unintended redistributive impacts of a reform based on actuarial fairness.

In Section 2 of this paper, we will present the data and the methods used in calculating CF*s*. In Section 3, we will assess increasing longevity and social inequalities in survival using educational level as a proxy for social class. In Section 4, we will present the CF*s* by gender and educational level for the year 2012, and discuss the most important results. In Section 5, we will look at which differences should be taken into account, and explore some ideas for reducing the social inequalities produced by '*actuarial fairness on average'* (as discussed on page 85).

2 Data and methods

In the '*1995 Dini reform*' (Table A.1, Appendix), the pension annuity – or the annual pension benefits – at retirement P in [1] is proportional to the capitalised value M of lifetime social security contributions (Lipsi 1999, Caselli et al. 2003), that is,

$$P = C_x M, \tag{1}$$

where C_x is the *Legislated Conversion Factor* (LCF) for retirement at age x, with x ranging between 57 and 70 years, which are, respectively, the lowest and the highest retirement age for which the coefficients are computed. The LCF is the same for men and women, and is equal to the inverse of the coefficients D_x:

$$C_x = \frac{1}{D_x} \tag{2}$$

D_x [3] is equal to the average of age-specific coefficients $D_{x,m}$ and $D_{x,f}$, computed separately for men (m) and women (f)

$$D_x = \frac{D_{x,m} + D_{x,f}}{2}, \tag{3}$$

We denote with $D_{x,s}$ the generic coefficients where s = sex (m = men, f = women), and is expressed as the sum of two components: the expected present value of a real annuity of one euro paid to the pensioner until his/her death, and the expected present value of the corresponding annuity subsequently paid to the surviving spouse.

The formula adopted by the legislators (published many years after the *'1995 Dini reform'* by the State General Accounting Office – RGS, 2014) may be obtained for each sex s and retirement age x, as follows:

$$D_{x,s} = \sum_{t=0}^{w-x-1} \frac{l^v_{x+t}}{l^v_x}(1+i)^{-t} + \beta \sum_{t=0}^{w-x-1} \left(\frac{l^v_{x+t}}{l^v_x} q^v_{x+t} a^F_{x+t+1} (1+i)^{-(t+1)} \right) - 0.4615, \tag{4}$$

where w is the maximum life span (set equal to 105 years); l^v_{x+t}/l^v_x is the probability of the pensioner at age x being alive at age $x + t$; t are the years spent in retirement; v refers to the *old-age* pensioner; i is the annual real discount rate (set at 1.5 per cent, which is assumed to be equal to the long-run annual growth rate of gross domestic product in real terms); and $\beta = \alpha * \gamma_s$ (set at 0.54 for a male pensioner and 0.42 for a female pensioner) is the fraction of the pension paid out to any surviving spouse ($\alpha = 0.60$) adjusted for the income limits of the beneficiary ($\gamma_s = 0.90$ if $s = m$ and $\gamma_s = 0.70$ if $s = f$). The parameters α and γ_s were introduced in the course of the 1995 Dini reform, without any further justification from lawmakers. q^v_{x+t} is the probability of dying between age $x + t$ and age $x + t + 1$ for a pensioner; a^F_{x+t+1} is the expected present value of a real annuity of one euro paid to any surviving spouse after the pensioner's death at age $x + t + 1$; F refers to the household of the deceased pensioner; and the constant 0.4615 is an actuarial adjustment that takes into account the fact that pensions are paid monthly.

It is easy to verify that the *Legislated Conversion Factor* C_x (LCF) is an increasing function of the discount rate and a decreasing function of the survival probabilities, the maximum life span, and the fraction of the pension paid out to the surviving spouse.

In this paper, the demographic parameters used in computing the conversion factors are as follows: the survival probabilities for both the pensioner and his/her surviving spouse, based on the life tables of the Italian National Institute of Statistics (Istat) for the year 2012; the death probabilities for old-age pensioners, which are the same as those of the Italian population considered in the previous 2012 life tables; and the annuity paid to the surviving spouse, which is calculated assuming a fixed age difference of three years between the husband and the wife. We based our assumption about this difference on our reading of the '*1995 Dini reform*', and not

on any justifications provided by lawmakers. This aspect of the reform turned out to be so controversial that lawmakers decided to make this assumption explicit for the conversion factors that were updated in 2016.

We have chosen to use the life tables for 2012 in this paper, as life tables by educational level are available for this year only.

For the mortality differential by educational level, we use three levels that are aggregated as follows (see the population distribution by age groups, gender, and education in Table A.2, Appendix):

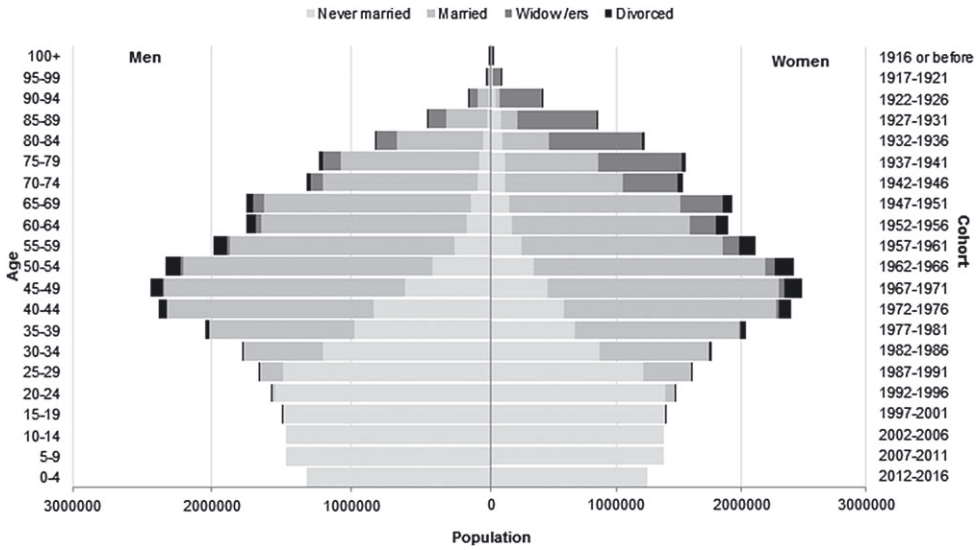
(a) Low for individuals with no qualifications, a primary school diploma, or a middle school diploma;
(b) Medium for individuals with a high school diploma; and
(c) High for individuals with a university degree or other higher education diploma.

3 Increasing longevity by gender, and survival differences by educational level

To provide a clearer picture of the ageing process in Italy, we present an image of the age pyramid of the Italian population (Figure 2). This pyramid takes the form of a tree with a trunk at the base that thins out as the number of births diminishes, while the foliage at the top grows as the number of individuals who reach old age rises. This structure is the result of the combined effects of the large generations born after the Second World War reaching old age and declining mortality rates at every age of life, which have allowed these numerous cohorts not only to reach old age, but also to survive into extreme old age. This growth pattern is more pronounced among women than among men: today in Italy, women over age 65 make up 24.4 per cent of the total population of women, whereas men over age 65 make up just 19.6 per cent of all men. The gender gap in survival is even greater after age 80, when the number of women who are widows and are living alone reaches its highest level (see Figure 2).

One relevant feature of this unprecedented imbalance in the age structure of the Italian population is an ageing process that shows no sign of stopping, and that is projected to peak in the 2030s, when the cohorts of baby boomers born in the 1960s reach retirement age. These are the cohorts that cause the central positions of the Italian pyramid to be so wide. However, in just over 20 years, when the baby boom cohorts are replaced by the baby bust cohorts born in the 1970s and 1980s, the share of the population supporting the growing number of retirees will inevitably decrease. According to Istat, the working age population (15–64) will decrease by three per cent between 2016 and 2031, even counting the arrival of new migrants (Istat 2017). Having recognised this process, and the advanced process of ageing combined with the increasing number of years lived in retirement, the Italian government has been

Figure 2:
Population by sex and marital status, Italy, 1 January 2016



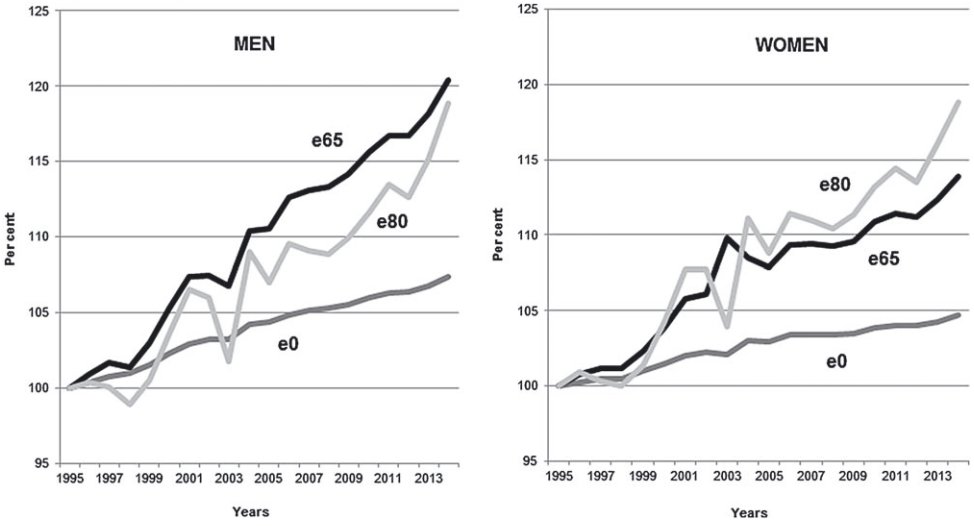
Source: Own elaboration on Istat data (Istat 2017).

forced to accelerate various aspects of pension reform, including the raising of the retirement age.

Figure 3 provides a clear picture of recent developments in longevity among Italians. The rates of increase in life expectancy at ages 65 and 80 have had much greater effects than the rates of increase in life expectancy at birth since 1995, the year of the *'1995 Dini reform'*. Between 1995 and 2014, average survival among men increased by 20 per cent at age 65 and by almost as much at age 80. Among women, who started with an advantage, average survival over the same period improved at a slightly lower rate, and increased the most among those aged 80 or older. While women maintained their survival advantage over the study period, the gender gap shrank from almost four years in 1995 to 3.5 years in 2014. The values displayed in Table 1 indicate that over this period, life expectancy at age 65 increased 3.2 years for men and 2.7 years for women. Thus, according to the life tables for 2014, an individual who had reached the age of 65 in that year could expect to live another 18.9 years if male or another 22.3 if female.

In line with recommendations made in the European White Paper (Zaidi 2010; European Commission 2012), Italian pension reform legislation has introduced control mechanisms for the number of years spent in retirement, which should remain more or less constant over time (around 20 years at the age of 65). These mechanisms help to ensure that the pension contributions are (more or less) evenly spread across an average number of years, and should make it easier to control the

Figure 3:
Index number (1995 = 100) of life expectancy at birth (e0), at 65 (e65), and at 80 (e80) by sex. Italy, 1995–2014



Source: Own elaboration on Istat data (Istat 2016a).

Table 1:
Life expectancy at birth (e0) and at age 65 (e65) in years, by gender, from 1995 to 2014, and differences (in years) between men and women at age 65. Italy

	Men		Women		Total (M and W)		Differences at age 65: W – M
Years	e0	e65	e0	e65	e0	e65	
1995	74.8	15.7	81.1	19.6	77.9	17.7	3.9
2009	78.9	17.9	84.0	21.5	81.4	19.7	3.6
2012	79.6	18.3	84.4	21.8	81.9	20.1	3.5
2014	80.3	18.9	85.0	22.3	82.6	20.6	3.4
Differences 1995–2014	5.5	3.2	3.9	2.7	4.7	2.9	0.5

Source: Own elaboration on Istat data (Istat 2017).

legal age of retirement when planning the pension system. We note that throughout the 1994–2014 period, if life expectancy at age 65 had been fixed at around 20 years, men would have been under the 20-year threshold, while women would have exceeded it by no less than two years.

The gap in life expectancy between men and women was ignored in the *'1995 Dini reform'* in the interests of actuarial fairness, as women pensioners were seen

Table 2:
Life expectancy at age 0 (e0), 65 (e65), and 67 (e67) in years by education and differences between levels of education (high and low). Year 2012. Men and women. Italy

Life expectancy	Men				Women			
	Level of education			Differences High – Low (in years)	Level of education			Differences High – Low (in years)
	Low	Medium	High		Low	Medium	High	
e0	78.6	80.9	82.4	3.8	83.2	85.3	85.9	2.7
e65	18.0	19.2	20.0	2.0	21.7	22.5	22.9	1.2
e67	16.5	17.6	18.3	1.8	19.9	20.8	21.1	1.2

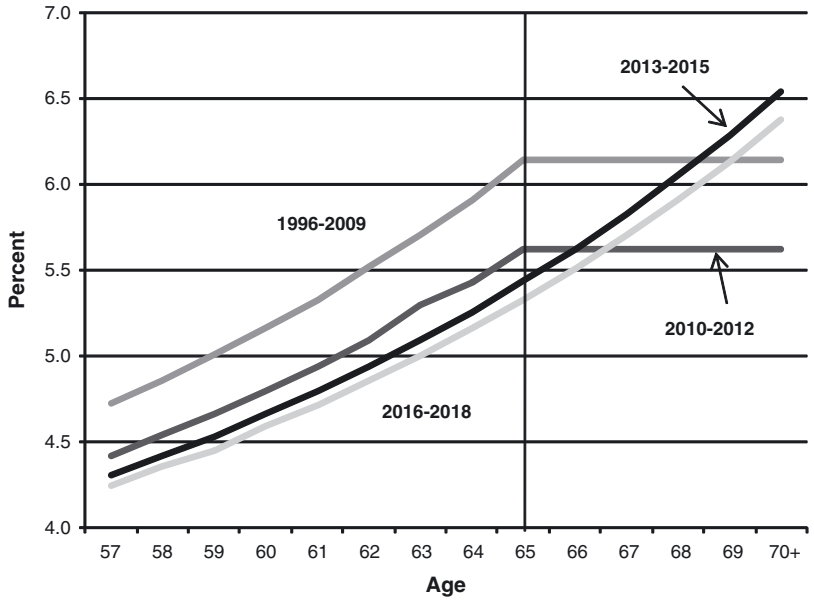
Source: Own elaboration on Istat data (Istat 2016a).

as receiving a 'premium' to compensate for maternity-related benefit losses. This turned out to be an exceptionally high premium, as 65-year-old women could look forward not only to surviving four years longer than men, but to retiring five years earlier (at age 60, their life expectancy was 24 years). As we have mentioned, the revision of this distortion was addressed in the 2010 reform, and was further corrected in the '*2011 Fornero reform*', which introduced a retirement option for women that encouraged early retirement only if a woman had at least 41 years and one month of contributions (up to December 2016). However, the retirement age for women has been gradually brought into line with that for men, and will reach the same level in 2019 (66.7 years, plus the increase in life expectancy).

Although the official retirement age will soon be the same for women and men, the Budget Law of 2016 and the Enabling Acts of 2017 envisaged reducing the years of contributions necessary for women to retire. Such changes effectively bring forward the retirement age indicated in the '*opzione donna*' decree of 2011, and thus reintroduce different retirement ages for men and women (for full information, see Pensioni Oggi (2017a)). But under these reforms, the choice to retire early will not be painless for women.

Levels of survival and of pension benefits vary not only by gender, but by social class. To understand this relationship, we look at educational level as a proxy for social class (see Luy et al. 2011; Zarulli et al. 2013). Table 2 shows that at birth, a man with a university degree can, on average, expect to live about four years longer than a contemporary with a low educational level. Among women, this difference is reduced to around three years. This gap is obviously smaller for survival at age 65, but it is still around two years for men and a little over one year for women (Marmot and Skipley 1996; Maier et al. 2011). If we then compare life expectancy at age 65 of a man with a low educational level and a woman with a university degree, we see that the woman has an advantage of no less than five years.

Figure 4:
Comparison between LCFs by age calculated from 1995 to 2018, annual real discount rate i = 1.5%



Source: Own elaboration on Pensioni Oggi data (Pensioni Oggi 2015).

How will these differences affect the calculation of the pension annuity, which is attributed to each individual of the same age and same life expectancy as the average Italian?

4 The impact of survival differences on annuity pension

4.1 Survival increase vs *Legislated Conversion Factors* (LCFs) decrease

We should recall that since 1995, when the first in a series of reforms in response to increased longevity was introduced, the LCFs have been updated no fewer than four times. Figure 4 compares the LCF*s* of the years 1996–2009 with those of the following years (Pensioni Oggi 2015). The life tables used in calculating these LCFs are the Istat life tables for 1995, 2002, 2008, and 2013.

The variations found in the LCFs are mainly attributable to increases in the probabilities of survival between ages 57 and 70. At the same ages, the coefficients have declined steadily from 1996–2009 until today. This was expected given the

increase in survival at all ages. It is, however, worth noting that at age 65, the LCF updated for the 2010–2012 period (before the '*2011 Fornero reform*') is half a percentage point lower than the LCF for the 1996–2009 period. To have a coefficient equal to that of a 65-year-old at the time of the *'1995 Dini reform'*, a person today would have to retire at the age of 69, a full four years later. Indeed, if we calculate life expectancy using the 1995 life tables for men and women together, we see that the life expectancy of an individual retiring at age 65 in 1995 was equal to that of an individual retiring at age 69 in the years 2016–2018 (following the life tables of 2013 (Istat 2016a)). However, the retirement age is now lower, at 66.7 years for men and 65.7 years for women.

As an example, consider a theoretical pensioner with a capitalised value M of 270,000 euros. We assume that the pensioner is legally permitted retire at age 65 in 2018, and has a pension annuity (14,380 euros and an LCF equal to 0.05326) that is 13 per cent lower than that of a person who retired in 2009 at the same age (16,567 euros and LCF equal to 0.06136).

4.2 Actuarial fairness and gender survival differences

As we have mentioned above (page 85), *'actuarial fairness on average'* works through the use of LCFs, and is therefore indifferent to the effects of demographic processes, including those that are associated with socioeconomic inequalities between individuals. Leaving aside our personal opinions about the wisdom of these choices, we are in favour of evaluating their effects on the future life of each pensioner, whose retirement pension is calculated on the basis of his/her contributions during his/her working life, is revalued, and is sub-divided into annuities on the basis of parameters that have taken into account the life expectancy of the average Italian of that age. This average life expectancy may be much longer or much shorter than the life expectancy of a particular pensioner's demographic or social group.

The conversion factors by gender (as CFs), updated using the life tables for 2012 (Table 3), show the importance of the survival increase at old ages. Consequently, the annuity received by a person retiring at age 65 is 1.7 per cent lower than the annuity calculated for the 2010–2012 period, when the LCFs were based on the 2002 Istat life tables. If conversion factors were allowed to vary by gender, then the annuity obtained by retiring at age 65 would be only 0.3 per cent higher for men, but would be 3.7 per cent lower for women.

When CF*s* are computed separately by gender, it becomes clear that the pension reform penalises men more than women. Looking at Table 3, we see that the relative differences between the gender-specific conversion factors tend to increase with age. We also note that the gains for women and the penalties for men are not perfectly symmetric. This pattern reflects the gender differential in survival, and the fact that the component of pension wealth is less important for a widow (0.42) than for a widower (0.54).

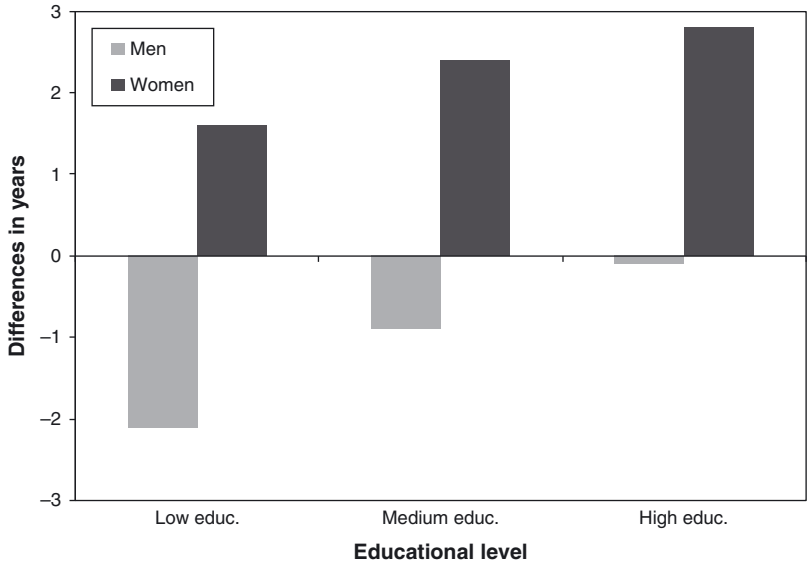
Table 3:
Comparison between Legislated Conversion Factors (LCFs) considered in the period 2010–2012 by age and those estimated by using 2012 life tables (CFs). Upper age at death 105 years. Men, women, and total. Italy

	Legislated Conversion factors updated 2010–2012	Conversion factors Life tables: ISTAT 2012 Maximum age 105			Deviations with current conversion factors (per cent)		
Age	Total	Men	Women	Total	Men	Women	Total
57	0.04419	0.04418	0.04276	0.04347	0.0	−3.2	−1.6
58	0.04538	0.04539	0.04388	0.04464	0.0	−3.3	−1.6
59	0.04664	0.04668	0.04508	0.04588	0.1	−3.3	−1.6
60	0.04798	0.04804	0.04635	0.04720	0.1	−3.4	−1.6
61	0.04940	0.04950	0.04771	0.04860	0.2	−3.4	−1.6
62	0.05093	0.05105	0.04915	0.05010	0.2	−3.5	−1.6
63	0.05257	0.05270	0.05069	0.05170	0.3	−3.6	−1.7
64	0.05432	0.05447	0.05234	0.05341	0.3	−3.6	−1.7
65	0.05620	0.05639	0.05412	0.05526	0.3	−3.7	−1.7
66	–	0.05846	0.05604	0.05725	–	–	–
67	–	0.06069	0.05811	0.05940	–	–	–
68	–	0.06310	0.06034	0.06172	–	–	–
69	–	0.06570	0.06277	0.06423	–	–	–
70	–	0.06851	0.06539	0.06695	–	–	–

Source: Own elaboration on Istat data (Istat 2016b).

Assuming a retirement age of 65 for men and women in 2012, and returning to the previous example, which fixes a theoretical capitalised value *M* of 270,000 euros for men and women, we can measure both the penalty for men and the differences between men and women. If the pension annuity is calculated for both men and women by following the CF_{65} (equal to 0.05526 – Table 3), the average annuity for a 65-year-old retiree with the sum indicated is equal to 14,920 euros. If, however, the CF_{65} is calculated separately by gender (0.05639 for men and 0.05412 for women – Table 3), each man has a pension annuity of 15,225 euros, and each woman has a pension annuity of 14,612 euros. The disadvantage for men produced by actuarial fairness is around 300 euros, and the difference between the annuities received by a man and a woman is no less than 613 euros (four per cent). These differences represent the impact of the annuity redistribution from lower male survival to higher female survival.

Figure 5:
Differences (in years) between life expectancy at age 65 by level of education (see Table 2) and life expectancy (M + W) at the same age (see Table 1) considered by the pension system (absolute values). Men and women. Italy. Year 2012



Source: Own elaboration on Istat data (Istat 2016b).

4.3 Actuarial fairness and educational survival differences

Before presenting the estimates of the CFs calculated on the basis of survival by educational level, it may be useful to examine the differences in life expectancy at age 65 for each group and gender, compared with the life expectancy used in calculating the legal coefficients at the same age ($e_{65(M+W)}$ = 20.1 years). It is clear from Figure 5 that among men, the most marked difference is negative, and is seen among men with the lowest educational level (2.1 years less than the average value). Among women, the maximum distance is positive, and is observed among women with a high educational level (2.8 years more than the average value). Among men, only those with a high educational level have a life expectancy at age 65 that is close to that of the average for 2012; while among women, there is a positive gap for all groups. These figures therefore show that even women who belong to the most disadvantaged group based on education have an advantage in the calculation of the CFs.

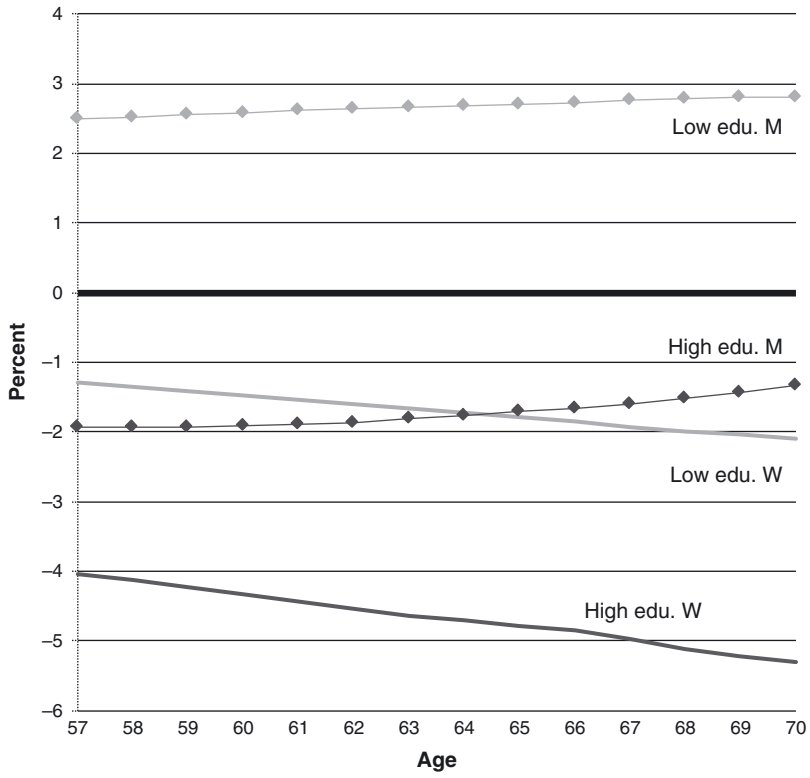
A comparison between the CFs that are estimated by level of education (low and high) that consider survival for men and women by age between ages 57 and 70 (see Appendix Tables A.3, A.4, A.5, and A.6 for a complete picture), and the CFs that

are estimated using 2012 life tables (undifferentiated by gender), shows that the only positive values are observed among men with a low educational level (Figure 6). The principle of actuarial fairness leaves these men with a disadvantage that is always two percentage points higher than the legal CFs, and this disadvantage increases with age. Thus, a man with a low educational level may find it less advantageous to work longer rather than to take early retirement. Looking at Figure 6, we see that women, unlike men, would have an incentive to retire too late. Indeed, we observe that the CFs of women by educational level are always lower than the legal CFs among women of both low and high educational levels. The particular evolution of CFs, including the differences between the CFs of men and women, has not been studied previously. From a demographic point of view, there are valid explanatory hypotheses for these behaviours that would involve analysing the characteristics of mortality at different ages.

It is important to keep in mind the gap in mortality. Figure 7 shows that for men with a low educational level, the age probabilities of death increase more with age than those of the average individual (probability of death calculated for men and women together); while for highly educated men, the probabilities of death tend to come closer with age to those of the average individual. The outgoing and approaching processes observed among men with low and high levels of education, and among men in the older age groups, are probably due to a cohort effect. Many of the men at the highest ages belong to the cohorts born in the immediate post-war period, when more men worked in heavy industry, which tends to be associated with high health risks; whereas the men aged 57–60 belong to the cohorts who benefited from the transition from the industrial to the service sector, which tends to be associated with lower health and mortality risks. We can also see significant differences in mortality from life-style risks, and from cigarette smoking in particular, which are lower among the youngest cohorts than among their older counterparts. Recent studies have shown that the 50–60-year-olds of today are less likely to die from cardiovascular diseases and, in particular, from cancers of the respiratory system than the oldest cohorts at the same and successive ages (Caselli and Egidi 2011; Caselli 2016). It is therefore to be expected that with the passage of time, when the elongated lives of tomorrow are the lives of the latest cohorts, the effects on the CFs for men highlighted in Figure 6 will be less pronounced, and will probably follow the trends observed among women. Indeed, if we look at female probabilities of death in Figure 7, we can see that these probabilities are always lower than the average value, and that the gap increases with age. It is worth recalling that the present cohorts of older Italian women had been largely kept out of the workplace and protected by a traditional culture. It is thus likely that these older women are living longer than men in part because they were protected from more harmful life-styles (particularly smoking) (Luy et al. 2011).

In general, when we compare the different mortality curves in Figure 7, we can clearly see that for every educational level, the average value does not represent either male or female values. This is the fundamental reason why the pension annuity for a man with lower education is strongly penalised when calculated

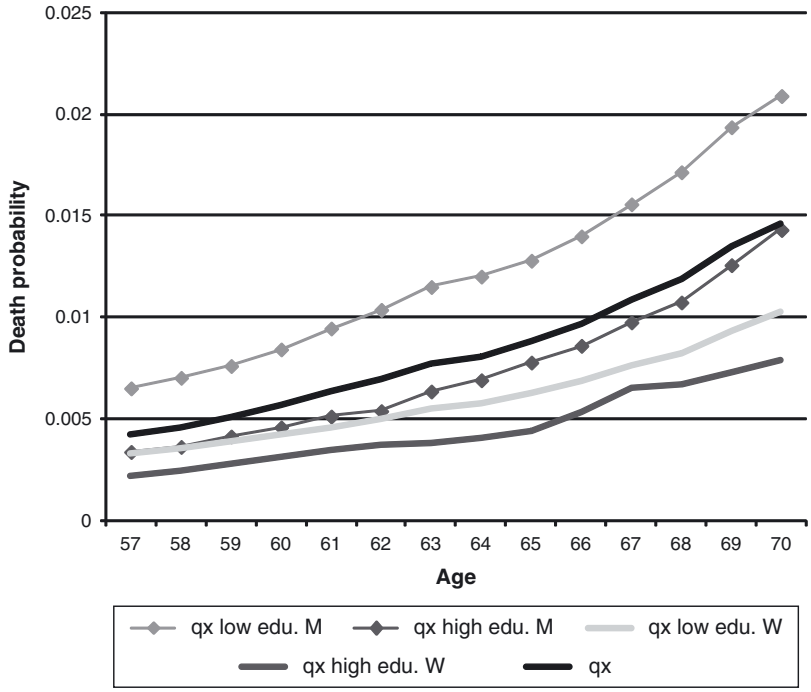
Figure 6:
Relative differences (per cent) by age, between CFs Total (=100) and CFs by level of education (low and high) for men (M) and women (W). Italy. Year 2012. (See data in Appendix Table A.6)



Source: Own elaboration on Istat data (Istat 2016b).

with the legal coefficients; while it is overvalued for a woman, regardless of her educational level. To evaluate the impact of education on pension annuities, let us consider here only the groups with extreme values, calculating their annuity levels by using the coefficients calculated for men and women together (CF Total) in one case, and the coefficients (CFs) that can be attributed to them according to specific survival levels in another case. Returning to the previous example, with a theoretical capitalised value *M* of 270,000 euros, it is interesting to note that (Table 4a) the pension received at age 65 by a man with a low educational level is 4.5 per cent – 659 euros a year – lower than that of a contemporary with a high educational level. This man is almost equally penalised if he delays retirement to age 67. Now let us compare the other extreme case: a man with a low educational level and a woman with a high educational level who are both retiring at age 65

Figure 7:
Death probabilities from ages 57 to 70 and by level of education (low and high) for men (M) and women (W). Italy. Year 2012



Source: Own elaboration on Istat data (Istat 2016a, 2016b).

with the same capitalised value *M*, and who therefore have an equal annuity of 14,920 euros. Differentiating their CFs by sex and educational level, we see that the pension annuity for the man would rise to 15,323 euros, while the pension annuity for the woman it would fall to 14,205 euros (Table 4b). The difference in the annuity amounts received by these two individuals is thus 1,118 euros (7.9 per cent). If the retirement age is raised to 67, the gender difference in annuity amounts at extreme educational levels is even higher in absolute (but also in relative) terms, at 1,237 euros (8.1 per cent).

The differences described in these examples illustrate very well the impact of the annuity redistribution from groups with lower life expectancy to groups with higher life expectancy. In general terms, as actuarial fairness does not take into account the heterogeneity of the population, and the varying prospects of survival between individuals belonging to different social classes in particular, the system fails to ensure a fair distribution of pension benefits between high-mortality groups (typically characterised by low levels of income and wealth) and low-mortality

Table 4:
Comparison between the pension annuity calculated with coefficients considering men and women together (CF Total), and CFs calculated for men and women by education. Retirement ages 65 and 67. Year 2012

(a)

			CF Men		Annuity Pension for men			Annuity differences between low high
Age	M*	CF Total	Low edu.	High edu.	CF Total	Low edu.	High edu.	educ. for men**
65	270,000	0.05526	0.05675	0.05431	14,920	15,323	14,664	659
67	270,000	0.05940	0.06104	0.05845	16,038	16,481	15,782	699

(b)

			CF Men	CF Women	Annuity Pension for men and women			Annuity differences between low edu.
Age	M*	CF Total	Low edu.	High edu.	CF Total	Low edu. men	High edu. women	men and high edu. women***
65	270,000	0.05526	0.05675	0.05261	14,920	15,323	14,205	1,118
67	270,000	0.05940	0.06104	0.05646	16,038	16,481	15,244	1,237

Source: Own elaboration on Istat data (Istat 2016b).
*M is the capitalised value of lifetime social security contributions.
**To explain – in part – the impact of the annuity redistribution from lower to higher survival for men by education.
***To explain – in part – the impact of the annuity redistribution from lower survival for men to higher survival for women by education.

groups (typically characterised by high levels of income and wealth) (Marmot and Skipley 1996; Elo 2009).

5 Reconciling actuarial fairness and inequalities in survival: New perspectives

In this paper, we have sought to highlight the importance of differential demographic processes, and of the crucial role played by varying prospects of survival in particular, when calculating conversion factors, which are among the key elements of the new Italian system of public pensions. How can we take the effects of these important differential processes into account?

Let us start with the assumption that the principle of actuarial fairness (*on average*) as defined by the system of the '*1995 Dini reform*' for calculating pension annuities will not be challenged, either politically or technically. We thus assume that the conversion factors will always be the same for all individuals, irrespective of differences in their life histories, including in their health conditions. Any reduction in pension annuities due to a calculation that overestimates the life expectancy of a pensioner who is already disadvantaged in terms of survival means that this pensioner will be penalised relative to those who will live longer than the survival level used in calculating the LCFs.

In addition, we should underline here that the example of the capitalised value M equal for all is a necessary simplification for measuring the sole effect of the CFs in calculating the pension annuity. It is, however, well known that in general, people who have a lower life expectancy are also more likely to belong to socially disadvantaged groups who tend retire at the same age with a lower capitalised value M as a result of the combined effects of a range of factors. First, because these groups have lower salary and income levels, the cumulative income from their contributions for the same number of years is lower. Second, these groups have lower annuity levels because, as we have seen, the coefficients for the calculation are based on life expectancies that are longer than theirs. The result is that the calculation of their pension annuity adds to the social inequalities these groups have experienced during their working lives and in their contributions.

Concerns about actuarial fairness *on average* should be even greater given that inequalities become more salient in the period of life when individual health is frailer. As well as having a lower life expectancy overall, people in the most disadvantaged social categories have a longer life expectancy in poor health (Coppola and Spizzichino 2014). A wide range of studies conducted in various European countries and the United States have shown that there are important differences by education in healthy life expectancy at each period of life and in old age in particular, and that differences in healthy life expectancy are even greater than differences in total life expectancy between educational groups (White and Edgar 2010; Crimmins and Saito 2001). This means that disadvantaged pensioners have to

cope with poor health with limited resources. Moreover, having limited resources may itself lead to a poor state of health. We certainly know that differences in life histories influence people's health histories and final outcomes, and can raise or lower the age at death. Studies of mortality based on macro-data have shown that the differences in the mortality histories of cohorts are the result of different life experiences (Caselli 2016).

The social and political debate on gender difference does not follow the same pattern. We have seen that the female advantage in survival at advanced ages has been constant, although it seems to have been decreasing slightly in recent years. It is also known, however, that while older women tend to live longer than men, their health is often worse. It thus appears that retirement affects the health of men more than that of women (Coppola and Spizzichino 2014). Jean-Marie Robine and his colleagues observed in 2009 (Robine et al.) that women live an average of six years (about four at age 65) longer than men, but that most of these additional years are lived with moderate or severe limitations in activity. They concluded that the disability-free life expectancy (DFLE indicator) gender gap in favour of women is, at less than two years, much smaller than the total longevity gap. This observation provides a different perspective on many of our previous findings on the effects of the redistribution of pension annuity benefits from groups with lower life expectancy (men) to groups with higher life expectancy (women).

The most convincing argument for the political decision to create a pension system that provides equal benefits to men and women is not that it maintains the principle of actuarial fairness (which is more technical than political), but that it compensates women for the obstacles they face in their working lives, especially those related to gender discrimination, motherhood, and greater family responsibilities (De Santis 2012, 2014). It is generally known that in all European countries, including in Italy, there are income gaps between men and women that benefit men (in 2014, the average difference was 19.3 per cent in Europe; and was 5.6 per cent in Italy), and that have yet to be closed despite multiple appeals by the EU Commission to address the problem (OECD 2017). Even when women have the same qualifications and work experience as men, there appears to be a sort of 'vertical segregation' that prevents women from making it to the top in their careers. It is also well known that women have extremely disadvantageous career structures because of their prolonged periods of absence due to pregnancy, childbirth, and child care. Taken together, these disadvantages a woman experiences during her working career can have a significant impact on the number of years she contributes, and on the capitalised value M paid in.

It seems to us wholly acceptable that women should be compensated after retirement for the benefits they have lost by devoting large parts of their lives to bringing up their children and caring for their families. Nevertheless we might wonder whether it is right to decide that the most disadvantaged individuals should have to compensate women for their disadvantages through reductions in their pension annuity levels. In our view, we should take into account that the most disadvantaged categories of workers are penalised enormously, both because of the

strenuous nature of their work, and, above all, because of the low pay they receive for doing it.

If we do not want to touch the principle of 'actuarial fairness' by setting up a pension system that is equal for everybody, we still need to intervene to prevent the already significant social inequalities from increasing upon retirement. Even as the various reforms were being passed, the need to bring forward the retirement age for some categories of workers without lowering their pension annuity levels was recognised. A proposal that was included in the Budget Law 2016–2017 strikes us as interesting. If implemented, it would represent the first improvement in pension benefits since the 2011 reform. Under this proposal, the retirement age would be made more flexible for the most disadvantaged workers (for the list see Pensioni Oggi (2017b)), allowing them to retire up to three years earlier without a reduction in their pension annuity benefits.

The only doubt we have about this proposal is that offering such flexibility to a limited category of workers might exclude many other workers who, though not included in the government's list, are among those who have been disproportionately penalised by the pension reform. Our analysis of life expectancy by education showed that all Italians with a low level of education have a life expectancy level at age 65 that is 2.1 years lower than that average level used in calculating the LCFs. Would it be possible to offer this group a form of 'free' flexibility with a coefficient revalued by two years for the early retirement age? We hope that future interventions by the government will consider this option as well.

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Appendix

Table A.1:
The most important stages of the Italian pension reform from 1995 to 2016

Reform Law	Acronym of the reform	Main changes
Law of 8 August 1995, No. 335	*'1995 Dini reform'*	Introduction of the contribution system: The amount of the pension depends on the amount of the contributions paid by the worker during his/her working life. Introduction of *Legislated Conversion Factors* (*LCFs*) and their revision every 10 years.
Delegated Law of 23 August 2004, No. 243	*'2004 Maroni reform'*	Introduction of a bonus for individuals who postpone the age at retirement for the *seniority* pension. Increase in the age at retirement for both kinds of pension: *seniority* and *old-age*. For women, the age at retirement for the *seniority* pension remains 57, but with severe cuts to the retirement allowance being calculated in full under the contribution system.
Law of 24 December 2007, No. 247	*'2007 Prodi reform'*	Introduction of the so-called 'quotas' for access to the *old-age* pension, determined by the sum of the age and the number of years worked. Reduction from 10 to three years of the revision of the *Legislated Conversion Factors* (*LCFs*) according to life expectancy calculated on ISTAT data.
Law of 30 July 2010, No. 122	*'2010 Sacconi reform'*	Introduction of an automatic update mechanism, triggered every three years, of the retirement age requirements to life expectancy levels.
Law Decree of 6 December 2011, No. 201 (so-called '*salva Italia*' decree')	*'2011 Fornero reform'*	Introduction of a pro-rata contribution system for all workers with at least 18 years of contributions in 1995 who have accumulated a pension that is entirely retributive. Further increase in the minimum retirement age for *old-age* pensions, with a different flexible retirement band for men and women that also takes into account the years of contribution by differentiating regular employees from the self-employed.

Table A.2:
Population (absolute – in thousands – and per cent values) by age groups, gender, and education. Years 2015. Italy

	Education							
	Low		Medium		High		Total	
Age groups	Absolute values	Per cent	Absolute values	Per cent	Absolute values	Per cent	Absolute values	Per cent
				Men				
15–19	1,323	89.5	154	10.5	–	–	1,478	100.0
20–24	483	30.7	1,008	64.1	83	5.3	1,574	100.0
25–29	533	32.4	803	48.8	308	18.8	1,644	100.0
30–34	706	39.4	729	40.7	358	20.0	1,793	100.0
35–39	902	42.9	830	39.5	371	17.6	2,103	100.0
40–44	1,128	47.2	869	36.4	393	16.5	2,391	100.0
45–49	1,349	55.0	783	31.9	320	13.1	2,452	100.0
50–54	1,293	56.7	712	31.2	275	12.1	2,281	100.0
55–59	1,095	56.1	615	31.5	243	12.5	1,953	100.0
60–64	1,041	59.6	477	27.3	229	13.1	1,747	100.0
65 and over	4,266	75.6	906	16.0	472	8.4	5,643	100.0
Total	14,119	56.3	7,886	31.5	3,053	12.2	25,057	100.0
				Women				
15–19	1,198	86.3	189	13.6	–	–	1,387	100.0
20–24	320	21.4	1,033	69.0	145	9.7	1,498	100.0
25–29	405	25.1	706	43.7	504	31.2	1,615	100.0
30–34	526	29.4	710	39.8	549	30.8	1,785	100.0
35–39	701	33.3	837	39.8	567	26.9	2,106	100.0
40–44	992	41.1	901	37.3	521	21.6	2,415	100.0
45–49	1,237	49.5	863	34.5	401	16.0	2,500	100.0
50–54	1,287	54.4	777	32.8	302	12.8	2,367	100.0
55–59	1,199	57.9	622	30.0	249	12.1	2,070	100.0
60–64	1,243	66.2	418	22.3	216	11.5	1,877	100.0
65 and over	6,295	85.2	758	10.3	339	4.6	7,392	100.0
Total	15,403	57.0	7,816	28.9	3,794	14.0	27,013	100.0

Source: Own elaboration on Istat Labour Force Survey (Istat 2017).

Table A.3:
Comparison between conversion factors considered in the 2010–2012 period by age and those estimated using 2012 life tables. Low level of education. Upper age at death 105 years. Men, women, and total. Italy

	Conversion factors updated 2010–2012	Conversion factors Life tables: ISTAT 2012 Maximum age 105			Deviations with current conversion factors (per cent)		
Age	**Total**	**Men**	**Women**	**Total**	**Men**	**Women**	**Total**
57	0.04419	0.04455	0.04291	0.04373	0.8	−2.9	−1.0
58	0.04538	0.04576	0.04403	0.04490	0.8	−3.0	−1.1
59	0.04664	0.04705	0.04523	0.04614	0.9	−3.0	−1.1
60	0.04798	0.04842	0.04650	0.04746	0.9	−3.1	−1.1
61	0.04940	0.04987	0.04785	0.04886	1.0	−3.1	−1.1
62	0.05093	0.05142	0.04929	0.05036	1.0	−3.2	−1.1
63	0.05257	0.05307	0.05084	0.05196	1.0	−3.3	−1.2
64	0.05432	0.05484	0.05249	0.05366	1.0	−3.4	−1.2
65	0.05620	0.05675	0.05427	0.05551	1.0	−3.4	−1.2
66	–	0.05881	0.05619	0.05750	–	–	–
67	–	0.06104	0.05826	0.05965	–	–	–
68	–	0.06344	0.06049	0.06197	–	–	–
69	–	0.06604	0.06292	0.06448	–	–	–
70	–	0.06883	0.06555	0.06719	–	–	–

Source: Own elaboration on Istat data (Istat 2016b).
Note: Some slight differences between our CFs and the LCFs are due to rounding decimals up or down.

Table A.4:
Comparison between conversion factors considered in the 2010–2012 period by age and those estimated using 2012 life tables. Medium level of education. Upper age at death 105 years. Men, women, and total. Italy

	Conversion factors updated 2010–2012	Conversion factors Life tables: ISTAT 2012 Maximum age 105			Deviations with current conversion factors (per cent)		
Age	**Total**	**Men**	**Women**	**Total**	**Men**	**Women**	**Total**
57	0.04419	0.04343	0.04212	0.04277	−1.7	−4.7	−3.2
58	0.04538	0.04461	0.04321	0.04391	−1.7	−4.8	−3.2
59	0.04664	0.04585	0.04437	0.04511	−1.7	−4.9	−3.3
60	0.04798	0.04718	0.04561	0.04639	−1.7	−4.9	−3.3
61	0.04940	0.04859	0.04692	0.04775	−1.6	−5.0	−3.3
62	0.05093	0.05009	0.04831	0.04920	−1.7	−5.1	−3.4
63	0.05257	0.05170	0.04980	0.05075	−1.7	−5.3	−3.5
64	0.05432	0.05342	0.05139	0.05241	−1.6	−5.4	−3.5
65	0.05620	0.05529	0.05312	0.05421	−1.6	−5.5	−3.5
66	–	0.05731	0.05498	0.05614	–	–	–
67	–	0.05948	0.05698	0.05823	–	–	–
68	–	0.06182	0.05913	0.06048	–	–	–
69	–	0.06437	0.06148	0.06292	–	–	–
70	–	0.06713	0.06400	0.06556	–	–	–

Source: Own elaboration on Istat data (Istat 2016b).
Note: Some slight differences between our CFs and the LCFs are due to rounding decimals up or down.

Table A.5:
Comparison between conversion factors considered in the 2010–2012 period by age and those estimated using 2012 life tables. High level of education. Upper age at death 105 years. Men, women, and total. Italy

	Conversion factors updated 2010–2012	Conversion factors Life tables: ISTAT 2012 Maximum age 105			Deviations with current conversion factors (per cent)		
Age	**Total**	**Men**	**Women**	**Total**	**Men**	**Women**	**Total**
57	0.04419	0.04263	0.04172	0.04218	−3.5	−5.6	−4.6
58	0.04538	0.04378	0.04279	0.04329	−3.5	−5.7	−4.6
59	0.04664	0.04500	0.04394	0.04447	−3.5	−5.8	−4.7
60	0.04798	0.04629	0.04515	0.04572	−3.5	−5.9	−4.7
61	0.04940	0.04768	0.04644	0.04706	−3.5	−6.0	−4.7
62	0.05093	0.04916	0.04782	0.04849	−3.5	−6.1	−4.8
63	0.05257	0.05076	0.04930	0.05003	−3.4	−6.2	−4.8
64	0.05432	0.05247	0.05089	0.05168	−3.4	−6.3	−4.9
65	0.05620	0.05431	0.05261	0.05346	−3.4	−6.4	−4.9
66	–	0.05630	0.05447	0.05539	–	–	–
67	–	0.05845	0.05646	0.05745	–	–	–
68	–	0.06078	0.05857	0.05967	–	–	–
69	–	0.06332	0.06088	0.06210	–	–	–
70	–	0.06606	0.06340	0.06473	–	–	–

Source: Own elaboration on Istat data (Istat 2016b).
Note: Some slight differences between our CFs and the LCFs are due to rounding decimals up or down.

Table A.6:
Comparison between conversion factors, by age, estimated using 2012 life tables (CF Total) and those by level of education (low and high) and gender. Upper age at death 105 years. Italy

	CFs Life tables: ISTAT 2012 Max age 105	Conversion factors by level of education (low and high) and gender				Deviations between total conversion factors and those by level of education (low and high) and gender (per cent)			
		Low education		High education		Low education		High education	
Age	Total	Men	Women	Men	Women	Men	Women	Men	Women
57	0.04347	0.04455	0.04291	0.04263	0.04172	2.5	−1.3	−1.9	−4.0
58	0.04464	0.04576	0.04403	0.04378	0.04279	2.5	−1.4	−1.9	−4.1
59	0.04588	0.04705	0.04523	0.04500	0.04394	2.5	−1.4	−1.9	−4.2
60	0.04720	0.04842	0.04650	0.04629	0.04515	2.6	−1.5	−1.9	−4.3
61	0.04860	0.04987	0.04785	0.04768	0.04644	2.6	−1.5	−1.9	−4.4
62	0.05010	0.05142	0.04929	0.04916	0.04782	2.6	−1.6	−1.9	−4.5
63	0.05170	0.05307	0.05084	0.05076	0.04930	2.7	−1.7	−1.8	−4.6
64	0.05341	0.05484	0.05249	0.05247	0.05089	2.7	−1.7	−1.8	−4.7
65	0.05526	0.05675	0.05427	0.05431	0.05261	2.7	−1.8	−1.7	−4.8
66	0.05725	0.05881	0.05619	0.05630	0.05447	2.7	−1.9	−1.7	−4.9
67	0.05940	0.06104	0.05826	0.05845	0.05646	2.8	−1.9	−1.6	−5.0
68	0.06172	0.06344	0.06049	0.06078	0.05857	2.8	−2.0	−1.5	−5.1
69	0.06423	0.06604	0.06292	0.06332	0.06088	2.8	−2.0	−1.4	−5.2
70	0.06695	0.06883	0.06555	0.06606	0.06340	2.8	−2.1	−1.3	−5.3

Source: Own elaboration on Istat data (Istat 2016b).