Life trajectories and transition to old age: Portugal as a case study

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BACKGROUND AND MOTIVATION

In the European context, the Southern countries are undoubtedly the most aged group in terms of the proportion of the number of elderly in the population and in relation to its recent growth. The aging evolution either in the past or future raises all sorts of debates and controversy, linked to its main socio-economic implications, in particular those related to the chances of sustainability of social security systems and health. However, the future consequences of the scale, proportion and rate of growth of population aging are likely to be influenced by different individual trajectories in terms of education and occupation, as well as the implementation of their family projects.

Demographic projections are a valuable instrument to contribute to the debate on these issues, in that it allows not only to predict future needs and behaviours, based on the analysis of past trends, but also allow to assume different scenarios of determining variables and evaluate their consequences.

Portugal is used here as a case study for being part of the group of most aged European countries and is a country where a sharp acceleration in the aging process was observed in the last two decades. In a first moment we evaluated the different individual trajectories regarding education level and employment situation, and secondly, the importance of family trajectories, with a special focus to the family dimension and marital status.

To do this, we have elaborated a projection of the initial total population for the next 50 years, using in the case of mortality a combination of probabilistic projection as an improved method originally proposed by Lee-Carter, and with scenario construction in the case of fertility. Population composition projections were also developed, such as household projections, school enrolment projections or retired population dimension projections. We used data from Statistics Portugal, Eurostat and Human Mortality database.

Our study allowed (1) to estimate a rapid and progressive increase of the elderly in a population in demographic decline, (2) for different scenarios of the population composition projections, to observe the influence of different trajectories of individuals and families in forecasting the future characteristics of the elderly population; (3) to recognize the tendency to postpone the transition to old age and to its (un)standardization, in that the increase of life expectancy and remaining number of years to live, under the conditions of mortality in perspective, allows to change the behavioural pattern in this period of life.

THE SCNEARIOS DEFINITION

The elaboration of population cohorts and components projections requires in-depth information about the behaviours of different components of a given population: fertility, mortality and migration. Only after a deep analysis of these three components we developed "what if" different scenarios.

However, if in the case of the two first demographic components their evolution is characterized by inertia, on the third component (migrations) the volatility characteristic of migration does not enable to foresee a more accurate future. In general, the projections with migration are seen as complementary to the natural movement of the population, projections calculated in the first place, even if the component migration proves highly influential population future structure. However the inclusion of migration in our projections will increase the volatility of the different scenarios, especially in the elaboration of population component projections. For this reason, and despite the different options you assume in our final population scenarios a set of hypotheses that seem more consistent, and that we will explain below, resulted then in nine (9) scenarios.

Our population working scenarios are:

1. Scenario of ***low mortality*** with ***low fertility;***
2. Scenario of ***low mortality*** with ***central fertility;***
3. Scenario of ***low mortality*** with ***high fertility;***
4. Scenario of ***central mortality*** with ***low fertility;***
5. Scenario of ***central mortality*** with ***central fertility;***
6. Scenario of ***central mortality*** with ***high fertility;***
7. Scenario of ***high mortality*** with ***low fertility;***
8. Scenario of ***high mortality*** with ***central fertility;***
9. Scenario of ***high mortality*** with ***high fertility;***

The results presented here are related to the so-called central scenarios (4, 5 and 6) were mortality evolution remains equal in the different scenarios and only the fertility evolution change. Nevertheless is important to understand how we proceeded to the definitions of the different scenarios.

Starting with the hypothesis of fertility evolution, we assumed, based on the use of total fertility rate (TFR) of 2011 (1.35 children per woman), that we would fluctuate between 1.3 to 1.8 children per woman, until 2061, according to the different scenarios previously defined. We can observe in Table 1, in the different scenarios that were called scenario "low", "central" and "high," and that, as the denominations indicate, refer to different possible perspectives for the future development of fertility in Portugal.

Table 1: Fertility possible scenarios

	Low Scenario	**Central Scenario**	**High Scenario**
2031	1,0	1,3	1,6
2061	1,3	1,6	1,8

Source: Statistics Portugal. Own calculations.

Concerning mortality, the elaboration of the scenarios was different. The approach adds greater reliability to the scenarios constructed taking into account its past evolution, until the jump-off year of the projection models using autoregressive ARIMA. Thus, the exercise was based on the model developed by Lee-Carter 1992 for forecasting the evolution of mortality and it is nowadays used in various studies of mortality projection (Lee 2000, Lee and Miller 2001, Coelho 2005). The application of this model allowed us to obtain a confidence interval of 95% to the estimates, which combined with the estimates result in the three scenarios elaborated. Table 2 shows more accurately what we just explained. Although the estimated values for life expectancy at birth evolve in all cases positively, the "low" scenario corresponds to a "slower " evolution, the " high" scenario to a "faster", in regard to the increase in years lived. It should be mentioned that the elaboration of these estimates was made taking into account the period between 1981 and 2011, since the broader historical range give greater consistency to the results.

Table 2: Mortality possible scenarios

	Low Scenario		**Central Scenario**		**High Scenario**	
	2031	**2061**	**2031**	**2061**	**2031**	**2061**
Males	76,86	79,11	80,28	84,53	83,07	88,39
Females	82,01	83,33	85,89	89,45	88,78	93,18

Source: Statistics Portugal. Own calculations.

As in the case of population projections, the household's projections also refer to the population living in a particular country or region. The projection of the households thus requires the prior existence of population projections obtained by the previous defined 9 scenarios. The method used by us is the headship household method. This method calculates the number of households based on a population projection (usually the central scenario

developed, in our case scenario 5), as well as the existing statistics on the proportion of family representatives belonging to every age group.

The study of different variables present in a population structure leads to developing projections, as its name implies, derives from the projections themselves. According to Louis Henry (1973), we call those population component projections, which are calculated considering as main characteristics age and sex. These projections cover areas ranging from school attendance, labour market, and households. The method used in these calculations is centred at first in-depth study about the recent past from which to determine what proportion of individuals of a particular sex and age, belonging to the category under study (students, active population, household heads) will be observed in a given year in the future. In a second moment, we multiplied the total of individuals belonging to that age and sex by that ratio, as effectively projected above.

RESULTS

The ageing process reflects not only in the future demographyc dynamic but also influences the evolution of other sub-populations usaly not so well studied. The existence of different scenarios of future population evolution considered in this exercise, allows us to foresee future behaviors, evaluate changes in trends, more or less marked, to identify patterns of variation always related to the original population.

According to the aim of our investigation, we will focus our attention on the population aged 65 years and older. Following this approach, we developed projections of households and calculated the population composition projections, including: the distribution of the population according to family size, by level of education, marital status, and also the

projection of the proportion of retired and finally, the proportion of institutionalized elderly population.

These new projection models were developed based on population structures obtained through the operationalization of the hypotheses that were the basis of the different scenarios used.

EVOLUTION OF THE PORTUGUESE POPULATION FROM 2011 TO 2061

Table 3 presents the values recorded in 2011 for the total population resident in Portugal, as well as for the specific case of all individuals aged 65 or more years old. Presents also an additional line with the value of the births in the same year, while it shows the estimates made for the years 2031 and 2061 corresponding to the central scenarios. With the analysis of this table, we can infer that, although the estimated total population is different between the selected scenarios and between successive time points analysed, with regard to the population over 65 years old we found that the same value is repeated to each scenario in each year observed. This situation is explained by the fact that these scenarios combine always the central mortality evolution with different assumptions of fertility. However, and as we have seen previously, the weight of the population over 65 years will change over the years, as the different scenarios estimated, determined by correlative change in the number of young people.

Furthermore, the evolution of the number of births also helps to explain the expected elderly population because if that number drops significantly until 2031, is diminishing continuously until 2061. Scenario 4 stands out as the worst of the scenarios presented in relation to the number of births, from 96 856 in 2011 to only 35 032 in 2061. In the opposite direction is the scenario 6,

recording the smallest decline between 2011 and 2061, with a forecast of 71 978 births.

Table 3: Total population aged 65 years +, and births in 2011, 2031 and 2061 for scenarios 4, 5 and 6 in Portugal

		2031			2061		
	2011	Scenario 4	Scenario 5	Scenario 6	Scenario 4	Scenario 5	Scenario 6
Population	10 561 614	9 660 745	9 820 730	9 980 737	7 146 507	7 783 295	8 406 140
Population	10 561 614	9 660 745	9 820 730	9 980 737	7 146 507	7 783 295	8 406 140
Births	96 856	53 372	68 353	83 347	35 032	53 579	71 978

Source: Statistics Portugal. Own calculations.

As expected, with the results presented so far, it is concluded that the aging population, combined with an effective decrease of the population residing in Portugal, has repercussions throughout the structure. Examining the proportion of individuals in accordance with different age groups presented in table 4, it can be seen that, in all the central scenarios we perspective a decline compared to the values observed in 2011. The decline is apparent for both the proportion of individuals with less than 15 years (with values between 13% and 8%, respectively in scenario 6 and 4, in 2061) and the active population (considered between 15 and 64 years), ranging between 52.5 % and 51.1 % at the end of the period.

This declining trend originates, in turn, a proportional increase in the weight that the inactive population will register in the total of residents.

Table 4: Proportion of population by functional groups in 2011, 2031 and 2061 for scenarios 4, 5 and 6 in Portugal

	2011	2031			2061		
		Scenario 4	Scenario 5	Scenario 6	Scenario 4	Scenario 5	Scenario 6
0-14	14,9	10,1	11,4	12,8	8,3	10,8	13,0
15-64	66,0	62,4	61,5	60,6	51,1	51,8	52,5
65+	19,1	27,5	27,1	26,7	40,7	37,3	34,6

Source: Statistics Portugal. Own calculations.

In table 5 is clear the level of aging forecasted for the future, in Portuguese society. We can observe that, for every 100 people at working age, there were, in 2011, about 52 (51.6) with less than 15 years and with 65 or more years old (considered non-active population). However, it is estimated that these values continue to increase in 2061 and the index value of total dependency (ratio between the proportion of non-active in the proportion of actives) is above 90 (90.6), and the group of the elderly accounts for about 73% in contrast to the current 56% (in 2011).

Regarding the value of the youth dependency ratio (ratio between the proportion of young in active population), we can see that the different scenarios estimate a decline until 2031. However, in 2061 its value is likely to be somewhat higher than that observed in 2011, of course, just in the case of a scenario where fertility increases steadily, reaching in 2061 the value of 1.8 children per woman. As for the old-age dependency ratio (ratio between the proportion of elderly people and actives) and the actual ageing index of the Portuguese population, we found that, although we can assume an increase in fertility after 2031, these indicators will continue to increase over throughout the projection horizon. If, in 2011, we were able to identify about 129 individuals aged 65 years and older for every 100 young people (i.e. those in the population who are less than 15 years), it is expected that this value will, at least to double in 2061. However, if we combine an evolution of life expectancy at birth 'central' with a 'low' fertility (scenario 4), the value currently registered by the aging index almost quadruple in 2061.

Table 5: Summary indexes in 2011, 2031 and 2061 for scenarios 4, 5 and 6 in Portugal

	2011	2031			2061		
		Scenario 4	Scenario 5	Scenario 6	Scenario 4	Scenario 5	Scenario 6
Total decency rate	51.6	60.3	62.7	65.1	95.8	92.9	90.6
Youth age decency rate	22.6	16.1	18.6	21.1	16.2	20.9	24.8
Old-age dependency rate	29.0	44.2	44.1	44.0	79.6	72.0	65.9
Aging Index	128.6	273.5	237.0	209.0	491.9	344.5	266.2

Source: Statistics Portugal. Own calculations.

THE PRIVATE HOUSEHOLDS

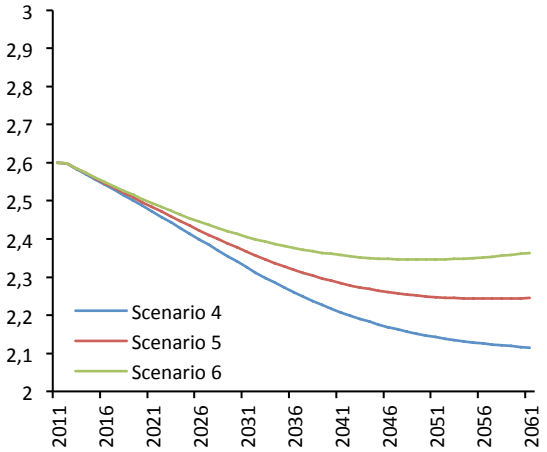
The aging population, as a result of increased life expectancy and decreased levels of fertility, along with profound socio-economic changes, changed family dynamics, and family size. The average family size, which was in 1960 equal to 3.3 individuals, decreased to 2.6 in 2011 (table 6). Looking ahead, between 2011 and 2061, can be seen in figure 1 that the trend will be for a further reduction in the average size of families. Scenario 6 is the one that has higher values, but in this scenario fertility levels are the highest. Fertility is the determinant factor that defines the different scenarios. However, the difference between the three scenarios under consideration is "minimal", and in 2031 the average family size will be 2.34 for scenario 4, 2.37 and 2.41 in scenario 5 in scenario 6. Already in 2061 the values will decrease to 2.11, 2.56 and 2.36 respectively.

Table 6: Portuguese average private household size at the census

	Average private household size
1960	3.7
1970	3.7
1981	3.3
1991	3.1
2001	2.8
2011	2.6

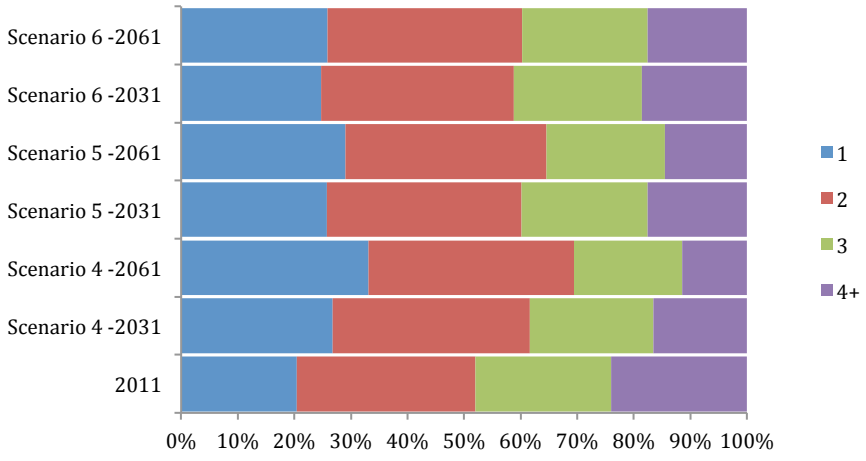
Source: Statistics Portugal. Own calculations.

Figure 1: Evolution of the Portuguese average private household size between 2011 e 2061 for the selected scenarios



Regarding the distribution of individuals according to the size of households (figure 2), we find that in 2011 predominated families composed by 2 elements, with a representation of 31.5% in total. This ratio keeps its values in different scenarios analysed for the years 2031 and 2061. However, the families constituted by 3 and 4 + decrease further their proportions, either in 2031 or in 2061. Also note that it is estimated that in any of the scenarios, the number of people residing alone steadily increase compared to 2011.

Figure 2: Distribution of the proportion of households, by size, in Portugal, in 2011, 2031 and 2061, by the scenarios under analysis



Source: Statistics portugal. Own calculations.

With regard to the proportion of household heads according to the age groups 15-64 and 65 + (table 7), it is possible to observe that in 2011, 69% of household heads had between 15 and 64 years old, while the population aged 65 years or more represented only 31%. However, according to different scenarios analysed, it is estimated, in the case of scenarios 4 and 5, a possible reverse of that tendency. As estimated, in 2061, in scenario 4, the household heads aged 65+ will represent 52% and in scenario 5 would find a balanced distribution of 50% in each of the age groups. This is reflection of the growing number of people living alone over 65 years, and the effect of reducing the working age population, implied by the different models. Only in scenario 6 is possible to observe, for the same year, lower values for the population over 65 years, although with values very close to those obtained in other scenarios.

Table 7: Proportion of household heads, by age groups, in Portugal, in 2011, 2031 and 2061, by the scenarios under analysis

	2011	Scenario 4		Scenario 5		Scenario 6	
		2031	2061	2031	2061	2031	2061
15-64	69	61	48	61	50	61	51
65+	31	39	52	39	50	39	49

Source: Statistics Portugal. Own calculations.

The proportion of households whose family representatives have 65 or more years of age, according to their marital status, shows an increase in all the estimated values, regardless of the year or scenario under observation (table 8). These results clearly demonstrate the growing importance of the number of households that will have a senior representative of the family, situation that will occur over the next fifty years, whatever the scenario adopted. However, it is estimated that is the proportion of married individuals that most likely will increase.

Table 8: Proportion of household heads aged 65+ by marital status in the total population at the years of 2011, 2031 and 2061

	2011	Scenario 4		Scenario 5		Scenario 6	
		2031	2061	2031	2061	2031	2061
Single	29	37	52	37	51	37	49
Married	26	35	48	34	46	34	44
Divorced	26	34	46	34	44	33	42
Widowed	22	29	41	29	39	29	37

Source: Statistics Portugal. Own calculations.

POPULATION COMPONENT PROJECTIONS

Low levels of education of the resident population have characterized Portugal, even in the recent past. However, this situation has been changing gradually. The government decision in 2012 to extend compulsory education until 12 years of schooling, covering all young people aged between 6 and 18 years old ensures that, in the near future, the evolution scenarios of the Portuguese population by completed highest level of education must not be based only on an extrapolation of past trends.

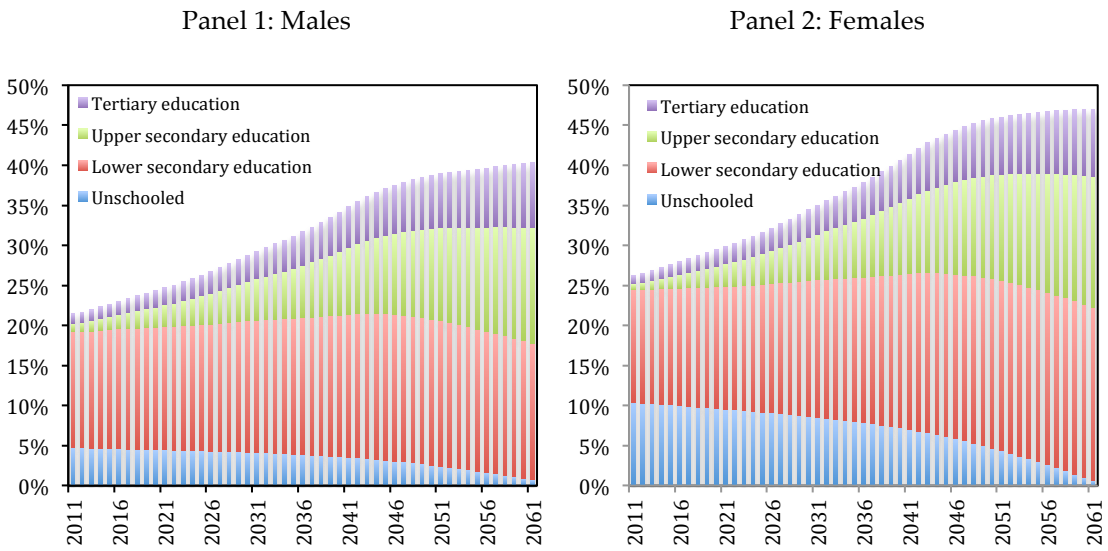
To forecast the senior population by level of education until 2061, we establish, in first place, that the Portuguese population, in general, will achieve the highest European patterns. Second, we assume that, in the particular case of the elderly, the extrapolation of a past trend characterized by a high proportion of individuals with basic schooling, or even without any schooling, still made sense in Portugal.

Thus, we assume the hypothesis that, in the coming decades, the education levels of the Portuguese population will be close to those currently observed in a country with higher education participation, as Sweden. Therefore, until 2061 the levels of education of its population will reach values currently registered in Sweden, being its evolution over the next fifty

years (applying the central scenario 5), in respect to both male and female population, as depicted in figure 3.

The proportion of residents who have basic education will remain with the largest representation in the overall senior population, in both sexes, with the largest proportion of growth experienced by individuals with secondary education. In principle, a higher level of education may be associated with better health and live conditions of older people.

Figure 3: Evolution of the proportion of the population aged 65 + in the total population, by educational level in scenario 5, between 2011 and 2061 in Portugal



Source: Statistics Portugal & Statistics Sweden. Own calculations.

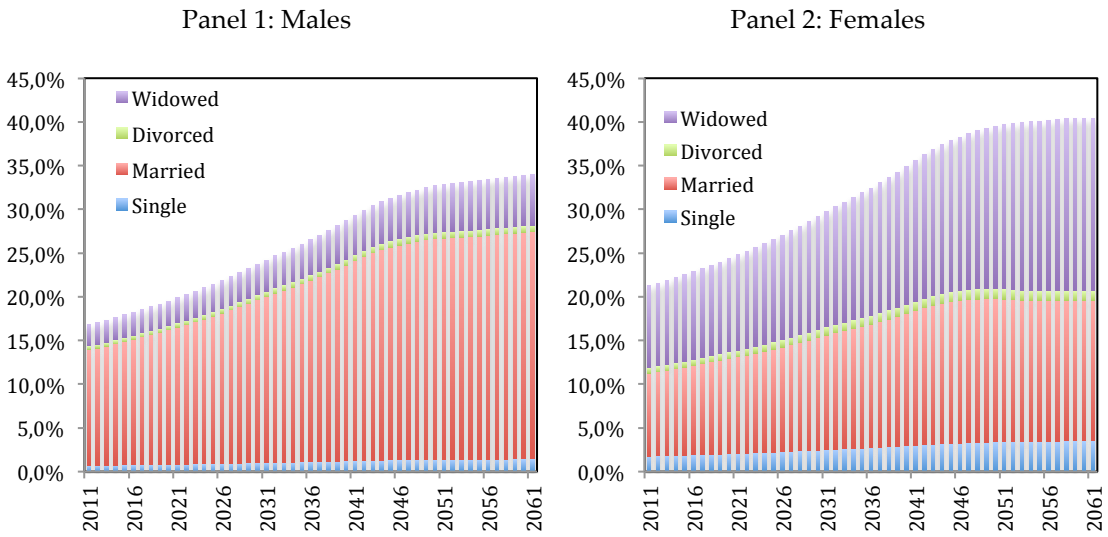
Table 9: Proportion of population aged 65 + in the total population, by educational level and sex, in scenario 5 for the years 2011, 2031 and 2061

	Males – Scenario 5			Females – Scenario 5		
	2011	**2031**	**2061**	**2011**	**2031**	**2061**
Unschooled	4.8	4.1	0.8	10.4	8.6	0.7
Lower secondary education	14.5	16.5	17.0	14.1	17.2	21.6
Upper secondary education	1.0	5.1	14.5	0.7	5.7	16.4
Tertiary education	1.2	3.4	8.1	1.1	3.6	8.4

Source: Statistics Portugal. Own calculations.

For seniors, it is of particular relevance to estimate the number of individuals by marital status. Some studies stated that the maintenance of the marriage works as a powerful mean to provide a healthier life and promote a consequent increase in longevity. In figure 4, it is possible to observe the likely changes between 2011 and 2061, in the proportion of seniors by marital status, also in the case of central scenario 5. We found the existence of substantial differences between the two sexes. These findings emphasize the high proportion of married men over 65 years, while for women the highest values are recorded in the cases of widowed population, reflecting a higher life expectancy for females and greater longevity.

Figure 4: Evolution of the proportion of the population aged 65+ in the total population by marital status in scenario 5, between 2011 and 2061 in Portugal

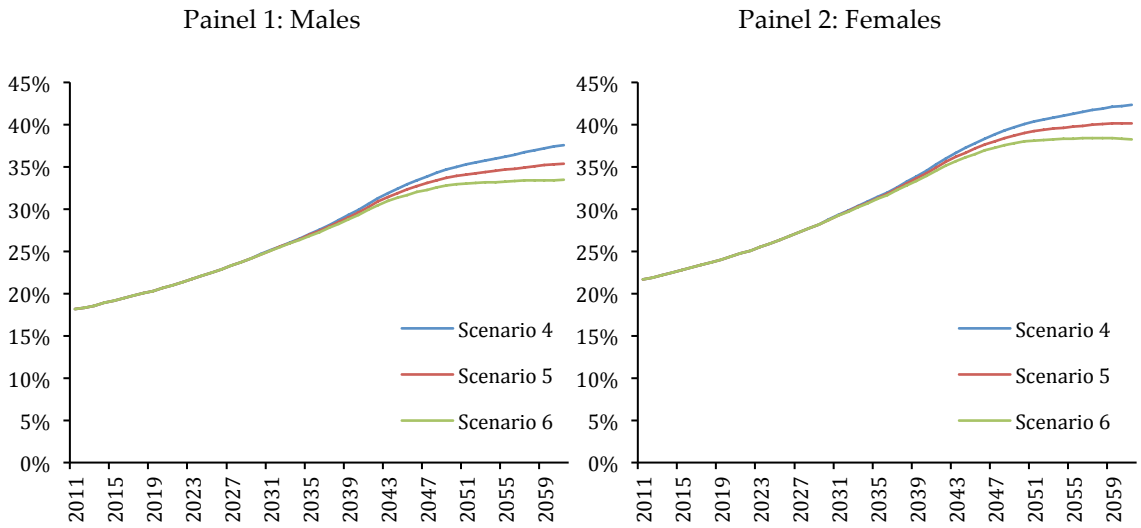


Source: Statistics Portugal. Own calculations.

The continuous aging of population will lead to the inevitable increase in the number of retirees as well as in their proportion relatively to the total active population. That number could be reduced if the government decreed an increase in the retirement age or, in proportional terms, offset by a significant increase firstly in the number births, followed later by an increase of young people participation in the labour market.

In figure 5 is possible to observe, for male and female, a steadily increase in the representativeness of the population of pensioners in total Portuguese residents. Women (panel 2), in 2061, will reach values of around 42% (central scenario 4) and men (panel 1) values of approximately 38% (central scenario 4). Although, for the scenarios 5 and 6, the proportions of men and women retired show lower values, they continue to represent values close to 40% of the total population.

Figure 5: Evolution of the proportion of the retired population aged 65 + in the total population between 2011 and 2061 in Portugal for the selected scenarios



Source: Statistics Portugal. Own calculations.

With a further analysis is possible to observe in table 10, the values of the proportions of male and female pensioners in total Portuguese population, in 2011, 2031 and 2061, according to the different scenarios analysed. If we assume scenario 4 as the most likely for the future of the Portuguese population, it is expected that the proportion of pensioners in the total population increase by 2061 approximately 20% in both sexes.

Table 10: Proportion of retired population aged 65 + in the total population for the years 2011, 2031 and 2061, in the selected scenarios

	2011	Scenario 4		Scenario 5		Scenario 6	
		2031	2061	2031	2061	2031	2061
Males	18,2	25,1	37,6	25,1	35,4	25,1	33,4
Females	21,7	29,3	42,3	29,2	40,2	29,2	38,2

Source: Statistics Portugal. Own calculations.

If the improvement of living conditions led to an increase in life expectancy at birth, this, in turn, resulted in an increase in the number of years that the senior population needs special care (including health care). It will thus be expected that the institutionalized population will increase in the coming decades, particularly for women, given their higher life expectancy, as well as their greater representation in the retired population. In 2011, in the total Portuguese population, the proportion of men over 65 years old, institutionalized, was 0.4%, while for women the value was around 1.1% (table 11). Keeping the same variation rate observed in the past, it is expected that for women, between 2011 and 2061, will be recorded the highest growth, with values of maximum 2.4%, depending on different scenarios. For men, the estimated changes will be lower, reaching 1.1% in 2061.

Table 11: Proportion of the institutionalized population in 2011, 2031 and 2061, with 65 + years in the total population, for the selected scenarios

	2011	Scenario 4		Scenario 5		Scenario 6	
		2031	2061	2031	2061	2031	2061
Males	0,4	0,8	1,7	0,8	1,5	0,8	1,4
Females	1,1	1,8	3,8	1,8	3,5	1,8	3,3

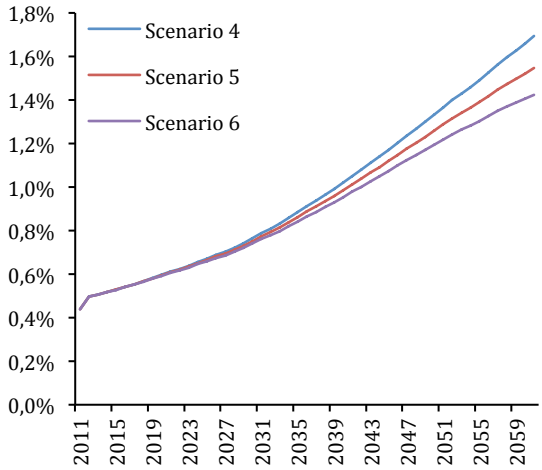
Source: Statistics Portugal. Own calculations.

It is possible, in figure 6, to identify a rising trend for both sexes. However, and despite showing a very similar evolution, the higher values provided for males are slightly above twice the recorded for females.

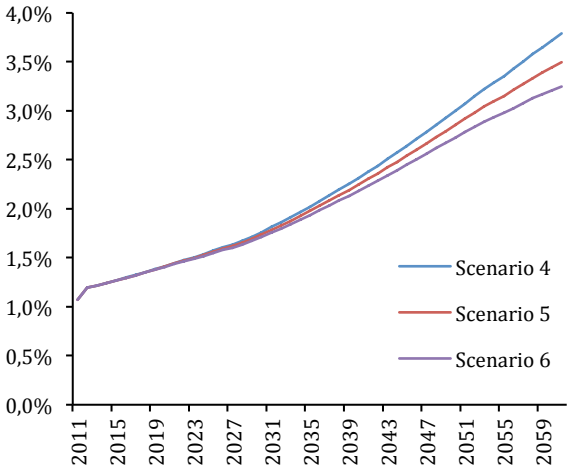
It is estimated that, for both sexes, the proportion of institutionalized population over 65 years old, in 2061, will increase threefold the recorded in 2011, whatever the scenario in question.

Figure 6: Evolution of the proportion of the institutionalized population aged 65 + in the total population between 2011 and 2061 in Portugal, for the selected scenarios

Panel 1: Males



Panel 2: Females



Source: Statistics Portugal. Own calculations.

Summarising, we can say that although the number of births may increase in some of the scenarios presented, in general, the proportion of young people such as of active population tends to decline over the next fifty years. Also the total size of the Portuguese population will undoubtedly decline, in the near future. Not foreseeing a significant slowdown in the evolution of life expectancy at birth, it seems that only a positive net migration will bring some renewal ability to a population that moves inevitably towards an accelerated aging process.

Final remarks

The population component projections presented in this paper are intended to predict what will be the features of future elders in Portugal. For that we intended to answer some questions that have been placed in the recent past: the seniors of the future will be better-educated, live mainly in family, live alone or in institutions? There will be more retirees and pensioners and more institutionalized seniors?

As for the family life context of elders, the prospects seem positive. In all the scenarios, the proportion of household heads aged 65+ tends to increase until 2061. That proportion was in 2011 only 31%, but in 2061 will rise to values around 50%, which means that in this regard, active seniors and younger population will be in social equality.

Regarding marital status, the trend is the same as in the family life context. In the total population, the proportion of married seniors will rise, reflecting the increase of this population. What seems somewhat puzzling and at the same time is completely new in 2061 is the highest proportion of singles seniors (29% in 2011 and 50% in 2061). But also the number of married and divorced will rise. Contrary to what one might suppose, the least represented marital status is widowed, remaining however most important among women.

By the law of aging and demographic evolution the number of pensioners will increase. But if senior mortality increases we should not exclude the hypothesis, demographically speaking, that Portugal will have less retired. There will also be less retired by considering the social policies that have increased the retirement age. The evolution of this population composition is uncertain. Nevertheless the general trend distinguished by our projection is that in 2061 there will be about 40% of pensioners in the total

population, which will be equivalent, compared to 2011, to an increase of 20% for both sexes.

As regards institutionalized seniors, it is difficult to reach a definitive conclusion. As we have seen, the integration of senior in the family reveals a tendency to improve in the future, which may be an obstacle to the use of public or private institutions. Our results reveals that, (1) in proportion, there will be up to 2061, an increase of older institutionalized; and (2) in 2061, the proportion of institutionalized women will be superior to men: 3.8% to 1.7% respectively in scenario 4, 3.5 to 1.5% in the scenario 5 and 3.3% to 1.4 in scenario 6.

The female's life expectancy, even though the difference compared to males may continue to decline, will always be higher, so women will continue to live longer. Women will live longer, with older husbands who die earlier. Furthermore, the majority of women will have a limited offspring what will contribute to an increase in loneliness of older couples and lead, later on, to a aloneness increase of women at older ages.

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