Is the Ageing of the French Population Unavoidable?

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Abstract – A population projection is not a certain prediction, but rather an estimate of what the future evolution of the population might be under certain assumptions about changes in mortality, fertility and migration, around a central scenario that suggests a continuation of recent demographic trends. This article looks at the assumptions made for the population projections conducted for France in 2016. It first reviews the approach used by Insee to establish them, and then examines the more or less certain nature of the main results. The ageing process observed for more than a century is expected to continue; however, if an indicator based on "prospective age" is used, the population would not age. The evolution of the population as a whole is uncertain. In 2070, the size of the population of the 28-member European Union would be close to that of 2019. The improvement in life expectancy combined with a positive migratory balance would compensate for a fertility level that does not allow for the renewal of generations.

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Population projections provide population estimates over various time periods, based on different assumptions. These are therefore not certain forecasts and some events may lead to significant differences between actual data and the projected data. One extreme example is the projection made by Alfred Sauvy in 1936, presented by Hubert *et al.* (1937), in a chapter entitled "*La dépopulation à craindre et les remèdes à lui opposer*" [Depopulation to be feared and the remedies to counter it]. If the demographic trends from that time had continued, France would have had around 29.6 million inhabitants in 1985 (see Appendix). However, there have been 25.6 million more than that. The projection assumed that fertility would continue to decline at the same rate as in the 1930-1935[1] period and obviously did not anticipate the post-war baby boom. Furthermore, it assumed that mortality would continue to decline at the same rate as in the 1925-1935 period. The authors even thought that this continuation of the decline in mortality was optimistic: "the projected number of deaths in 1985 may seem unrealistically low, as it corresponds to a 65% reduction in age-specific mortality for both men and women under the age of 50" (Hubert *et al.*, 1937, p. 217). However, the projection proved to be pessimistic, since mortality fell at a greater average annual rate between 1935 and 1985 than over the 1925-1935 reference period. According to the 1937 projection, the death toll in 1985 would have been 556,000, giving a mortality rate of 1.9%, almost two times higher than the rate actually recorded in 1985 (1.0%). Similarly, net migration was assumed to be zero. The authors indicate that "if population growth continues to slow down more and more in Europe, the source from which we have drawn our migrants will quickly dry up". Finally, net migration was clearly positive every year between 1946 and 1985.

This historic example illustrates the importance of the assumptions made in making population projections. These projections are very important for informing public decisions, such as those concerning, for example, the balance of the pension system, the number of educational institutions, early childcare facilities, etc. A demographic projection typically refers to the population, broken down by sex and age. Additional modelling can enrich the projection, in accordance with other variables of interest, such as region of residence (Desrivierre, 2017), professional activity (Koubi, 2017), state of health and level of dependency (Roussel, 2017), for example.

Two major approaches are possible for estimating the future population: deterministic and probabilistic. The deterministic approach makes it possible to estimate "what would happen" under a set of assumptions that define a scenario; this is the approach used for the population projections published by Insee in 2016. Several sets of assumptions make it possible to develop several scenarios. The most robust results are those that are obtained in all scenarios, while the weakest are those that vary greatly depending on the scenario. Assumptions can be developed based on extrapolation of past trends, the establishment of long-term trends (based, in particular, on expert opinion) or a structural model that explains population change using exogenous variables, and often a combination of these elements (Costemalle, this issue).

Probabilistic approaches quantify uncertainty over "what would happen" with a given probability. In this case, a large number of projections must be made to calculate a confidence interval. Here, the sets of assumptions are based on the modelling of fertility, mortality and migration. For France, the projections resulting from the two approaches are not very far apart: thus, the population size in metropolitan France in 2050 obtained using the central scenario of the deterministic approach differs from that obtained in the median scenario of the probabilistic approach by only 2% (Costemalle, this issue).

Whether the deterministic or probabilistic approach is used, the component method is generally applied. This involves "ageing" the last-known age pyramid from year to year, with the aim of determining the age pyramid for a certain number of years. The Swedish statistician Sven Wicksell was one of the first to use this method to estimate the evolution of the Swedish population in 1926 (Wicksell, 1926; Wattelar, 2004). Only a few events can change a country's population upwards or downwards: births, deaths and migration. The assumptions therefore concern future developments in fertility, mortality and net migration. The population is then changed by sex and age, by adding births by sex, subtracting deaths by sex and age and adding net migration by sex and age.

This article primarily focuses on the assumptions of the population projections established for France in 2016. The first section reviews the approach adopted by Insee to establish those projections. The second section is devoted to the main results, distinguishing between those that

1. *The fertility rate fell from 2.3 to 2.1 over the period.*

are relatively robust and those that are weakest. Finally, the third section compares France's situation with that of its European Union (EU) neighbours using projections published by Eurostat in 2019.

1. The Assumptions of the 2016 Population Projections for France

To develop the assumptions, Insee called upon both national experts, researchers and representatives of various institutions using the projections or specialists in certain fields,[2] and international experts, most of whom are responsible for population projections in their countries. Twenty-five of them responded to a questionnaire on the evolution of mortality, fertility, migration, the projection horizon and the method to be used. The responses, which are summarised here, are detailed in Blanpain & Buisson (2016a). Population projections are revised approximately every 5 years in France.

A projection horizon of 2070 was appropriate for most of the experts who gave an opinion on this subject. Two experts would have preferred a longer projection horizon and three would have preferred a shorter one. The projection horizon of 2070 was therefore used.

Most of the experts agreed on the complementarity of the deterministic method and the probabilistic method. The deterministic method was chosen because it allows for easier communication to a non-specialist audience. It also makes it easier to make derived projections (e.g. active population projections).

This projection is based on the component method. It consists in estimating the population for the following year (year n+1) based on the starting population (year n), then adding births and net migration (immigration – emigration) and subtracting deaths, then repeating the operation year after year:

$$Pop_{n+1} = Pop_n + Birth_n - Death_n + Net\,Migration_n$$

In France, population estimates and statistics from the civil status registry make it possible to estimate age-specific fertility rates in previous years and to establish the history of mortality rates, i.e. the probability of dying within the year by sex and age. Net migration rates by sex and age are established by the difference in successive populations and the natural balance (births – deaths).

Most of the experts approved the choice to use an odd number of assumptions, allowing a central scenario to be defined. Three assumptions (central, low and high) were made for each of the components, mortality, fertility and migration. The central assumption is generally that of a continuation of recent trends. The low assumption uses a slower evolution than in the past and the high assumption uses a faster one. Projections based on the continuation of trends, as in this case, are unable to predict trend reversals by definition. The analysis of the differences between the evolutions observed and earlier projections (Blanchet & Le Gallo, 2014) calls for caution, which leads to the use of several scenarios to analyse the sensitivity of results to different assumptions.

One scenario is based on one assumption for fertility, one for mortality and one for net migration. The combination of the three assumptions (central, low and high) for each component results in twenty-seven scenarios. Of these scenarios, the central scenario combines the central assumptions of the three components. Six scenarios illustrate what would happen if only one of the assumptions was changed compared to the central scenario: the low and high life expectancy scenarios, the low and high fertility scenarios and the low and high migration scenarios. In addition, four alternative scenarios combine the assumptions leading to a low, high, young or elderly population. For example, the elderly population scenario combines an assumption of high life expectancy, low fertility and low migration.

Finally, three other scenarios were also constructed, making it possible to estimate what would happen if France's fertility rate was the same as the European fertility rate in 2015, if life expectancy remained at its 2014 level or if net migration were zero.[3]

1.1. Mortality

The central assumption assumes that mortality will continue to fall at the same rate as in the past until the projection horizon. This therefore requires the definition of a reference period for said past. The reference period chosen here is 1995-2014. This includes the year 2003, when there was a heat wave and mortality increased particularly at high ages, as well as the following

2. Including: The Conseil d'orientation des retraites [Pension Advisory Board] (COR), the Direction de la recherche, des études, de l'évaluation et des statistiques [Directorate of Research, Studies, Evaluation and Statistic] (Drees), the Institut national d'études démographiques [National Institute for Demographic Studies] (INED), the Institut Paris région [Paris Region Institute] and the Institut national de la santé et de la recherche médicale [National Institute of Health and Medical Research] (INSERM).
3. The assumptions and results for all scenarios have been published (Blanpain & Buisson, 2016b).

year 2004, when life expectancy rebounded exceptionally, by +11 months for both men and women (Papon, 2019). In the end, the heat wave episode paradoxically had a rather positive long-term effect on the evolution of life expectancy thanks to preventive measures aimed at the elderly in particular (Pison, 2007). The reference period is quite long, twenty years from 1995 to 2014, so as to smooth out the impact of 2003-2004. However, the most recent trends are somewhat different: in particular, life expectancy is stagnating or increasing less quickly in some European countries, including France. According to Eurostat, life expectancy in the 28-member EU is 81.0 years in 2018, which is the same level as in 2014 (80.9 years). In France, between 2014 and 2019, life expectancy rose by only 0.2 years for women and 0.5 years for men (Beaumel & Papon, 2020). Indeed, three of the five years from 2014 to 2018 were marked by a relatively deadly flu epidemic (Équipes de surveillance de la grippe, 2018). However, the slower progress in life expectancy may also be a sign that the benefits of the "cardiovascular revolution" are coming to an end (Pison, 2019). Furthermore, among women, mortality linked to cancer has stopped falling in recent years, particularly due to the rise in smoking in the 1950s to 1980s among those aged 50 or older today (Pison, 2019). The reference period chosen therefore leads to a slightly more optimistic projection than if the latter data had been known. At the time the assumptions were constructed, this stagnation was not anticipated, or at least not as a sustainable phenomenon to be included in the central long-term population projection. The question of the sustainability of the slowdown in improvements to life expectancy will arise in the next projection exercise.

The selection of assumptions for a projection is also partly explained by the lessons learned from past projections, in particular from the errors made at that time. Thus, the projections made in the 1970s and 1980s in France assumed that life expectancy would reach a ceiling in the more or less long term, believing that it was approaching a biological limit. However, that level proved to be far below the values observed subsequently (Blanchet & Le Gallo, 2014). For example, the 1979 projection resulted in a life expectancy of 78 years for women and 70 years for men in 2015, which is 7 years and 9 years less, respectively, than was ultimately observed. Starting in the 1990s, therefore, the projects adopted the approach of extrapolating past mortality trends without capping them, leading to results much closer to the observed data.[4] The 2016 projection is therefore based on a continuation of the mortality trends without a cap.

However, a novelty has been introduced, following the recommendations of one of the experts: the projection of mortality rates according to past trends has been amended to take into account a generational effect. Indeed, while age-specific mortality generally decreases from generation to generation, it stagnates in adulthood for generations born at the end of the Second World War or just after, for both men and women. For example, this stagnation is visible at age 50 for women (Figure I). At that age, the probability of dying within one year was 2.5 per 1,000 for women born in 1941, which is virtually identical to that for women born in 1956 (2.4 per 1,000, or -2%), while it fell for the previous generations born between 1931 and 1941 (-21%) and for later generations born from 1956 to 1966 (-21%). This plateau is observable for most adult ages, indicating a generational effect not related to the time period. One way to summarise this generational effect is to observe the probability of dying between two given ages (Figure II). For example, among women who have reached the age of 18, the probability of dying between the ages of 18 and 54 falls fairly little between the generations born from 1941 to 1956 (-9% in 15 years) and rapidly between the previous generations born from 1931 to 1941 (-22% in 10 years) and the following generations, born from 1956 to 1965 (-18% in 9 years).

This specific evolution is taken into account in the projections. The generational effect that is visible up to the age of 70[5] is thus assumed to continue until the end of the life of the so-called "plateau" generations, born between 1941 and 1956 for women and between 1941 and 1953 for men. In concrete terms, for the central assumption, the average annual rate of change in mortality at age 59[6] is calculated between the 1941 and 1956 generations for women (between 1941 and 1953 for men) and the same rate is applied to the following ages (see Figure I).

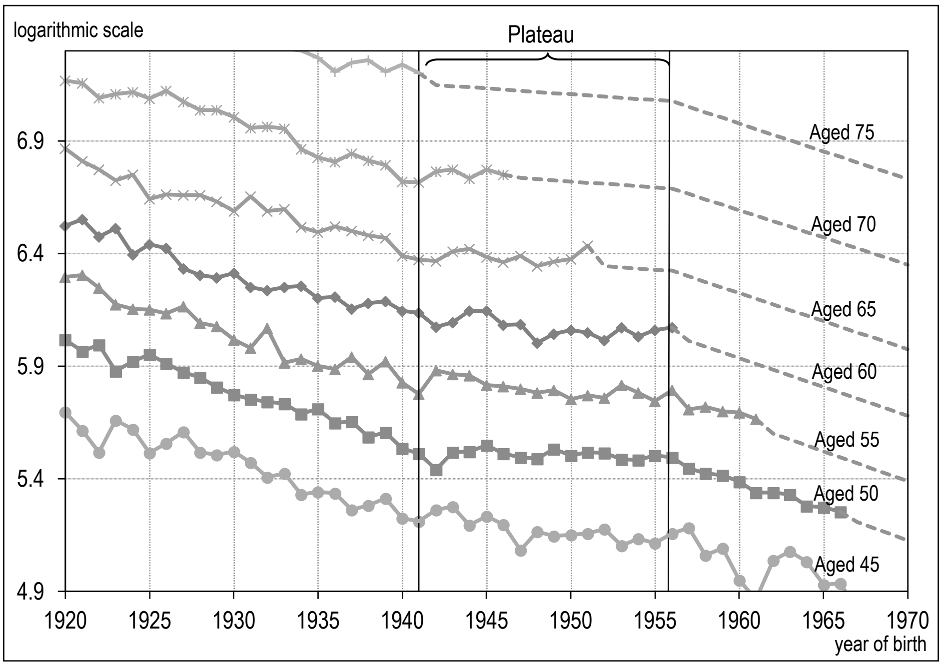
The annual rate of change in mortality rates around the age of 50 for the generations born from 1956 onwards is yet to be determined. Indeed, applying the rates of change in the mortality rates observed during the reference period would

4. Thus, for women, the projections for 1995, 2003, 2006 and 2010 all led to a life expectancy close to 85.5 years in 2015, which is a difference of less than one year compared to the observed situation. For men, the 1995 projection was somewhat pessimistic (a difference of two years) and the projections for 2003, 2006 and 2010 are close to the observed reality (a difference of less than one year).

5. At this age, only the start of the plateau is observed.

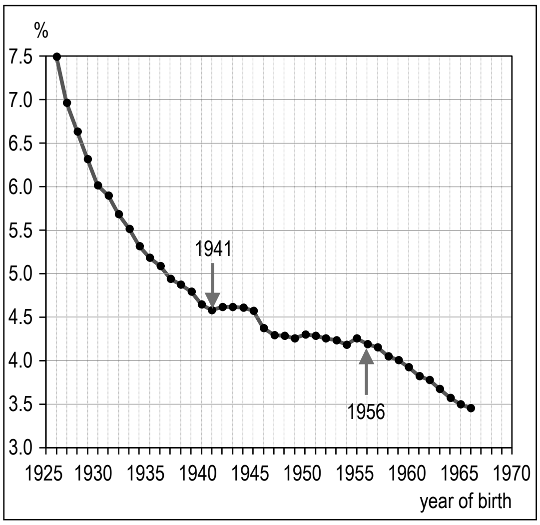
6. Age reached in 2015 by the generation born in 1956.

Figure I – **Female mortality rate by age and year of birth**



Reading Note: The probability of dying at age 50 for women born in 1966 is 1.9 per 1,000. This is calculated as follows: exp(5.3)/100.
Sources and coverage: Insee, population estimates and civil status registry statistics from 1965 to 2016; Insee, central population projection scenario from 2017 onwards. Metropolitan France for years up to 1990, France excluding Mayotte from 1991 to 2013, France from 2014 onwards.

Figure II – **Probability of dying for women aged 18 to 54 by year of birth**



Reading Note: Among women born in 1966 and alive at age 18, the probability of dying between the ages of 18 and 54 is 3.5%.
Sources and coverage: Insee, population estimates and civil status registry statistics. Women alive at age 18, Metropolitan France for years up to 1990, France excluding Mayotte from 1991 to 2013, France from 2014 onwards.

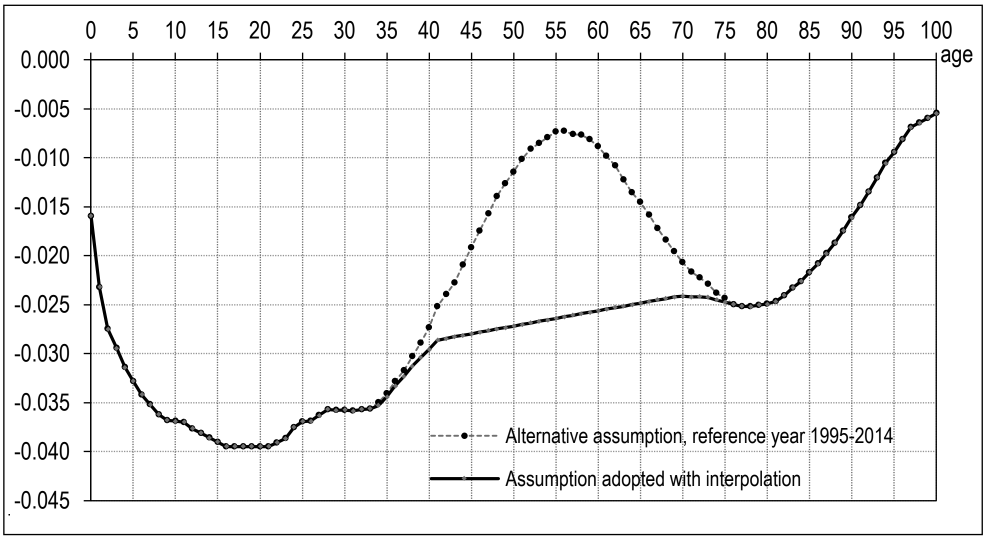
slow the decrease significantly. For example, to calculate the evolution of mortality rates at age 50 that will be experienced by the generations born from 1970 to 2020, the 1995-2014 reference period concerns the generations born from 1945 to 1964 who turned 50 during that period. This largely includes the "plateau" generations, for whom the decrease has slowed, while there is no reason to assume that this slowdown will affect later generations. The assumption used is that mortality resumes its downward trend for these generations. Thus, mortality at age 50 is declining at a steady rate, as was already the case before the plateau generations reached that age. The rate of decline is determined by interpolation between two ages (Figure III).

An alternative assumption, simply continuing past trends without taking the generational effect into account, has been tested. The assumption used and the alternative assumption lead to virtually the same life expectancy at birth in 2070 (Blanpain & Buisson, 2016a). Taking into account the generational effect leads to two compensatory effects: a slowdown in the decline in mortality for the generations born at the end of the Second World War or just after, and an acceleration in the decline in mortality at the age of around 55 for later generations. The evolution of life expectancy at age 60 is a little slower when using the chosen method (taking into account the generational effect) compared to the alternative method, particularly at the beginning of the period. For example, in 2037, the difference is -0.6 years for men and -0.8 years for women.

In summary, the assumption chosen as the central assumption is as follows:

- At each age, mortality continues to fall at the same rate as in the period 1995-2014, unless

Figure III – **Annual evolution of the female mortality rate logarithm by age**



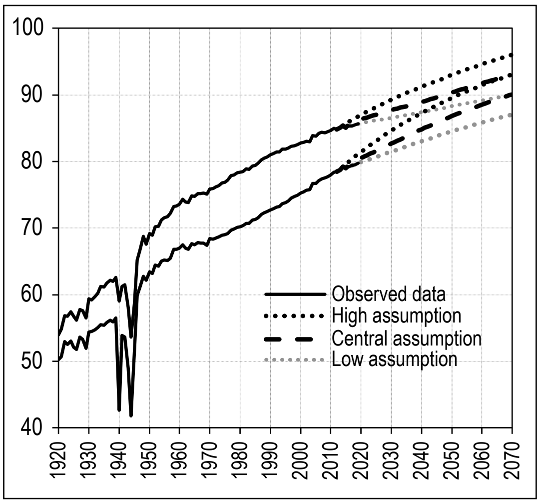
Reading Note: The annual decrease in the mortality rate logarithm for women aged 50 is -0.011 over the 1995-2014 period, on average.
Sources and coverage: Insee, population estimates and civil status registry statistics. Metropolitan France for years up to 1993, France excluding Mayotte from 1994 to 2013, France from 2014 onwards.

these years include the 1941-1956 generations for women (1941-1953 for men).

- If these years at least partially include these generations, the decline is calculated by interpolation.

- For the 1941-1956 generations, for women (1941-1953 for men), mortality is virtually stable at each age and the central assumption is that it will remain so.

Figure IV – **Life expectancy at birth according to different assumptions**



Reading Note: In France, female life expectancy at birth is 85.6 years in 2019.
Sources and coverage: Vallin & Meslé, French mortality tables for years until 1945; Insee, population estimates and civil status registry statistics from 1946 to 2019; Insee, population projections from 2013 to 2070. Metropolitan France for years up to 1993, France excluding Mayotte from 1994 to 2013, France from 2014 onwards.

The central assumption results in life expectancy at birth of 90 years for men and 93 years for women in 2070, which is an increase of 10.4 years for men and 7.4 years for women since 2019 (Figure IV). By way of comparison, between 1968 and 2019, a period of the same length (51 years), life expectancy for men increased slightly faster (11.9 years), while it increased significantly faster for women (10.4 years). The differences in life expectancy between men and women have reduced since the mid-1990s. Since then, male mortality has fallen more rapidly than female mortality, thanks in particular to the reduction in violent deaths and deaths due to cancer or AIDS (Meslé, 2006). According to the central assumption, life expectancy for men will become even closer to that for women, with the difference being just 3 years in 2070, compared to 6 years in 2019. Consequently, the rebalancing between men and women at older ages should continue. In 2070, 39% of people aged 95 would be men, compared to only 23% in 2020.

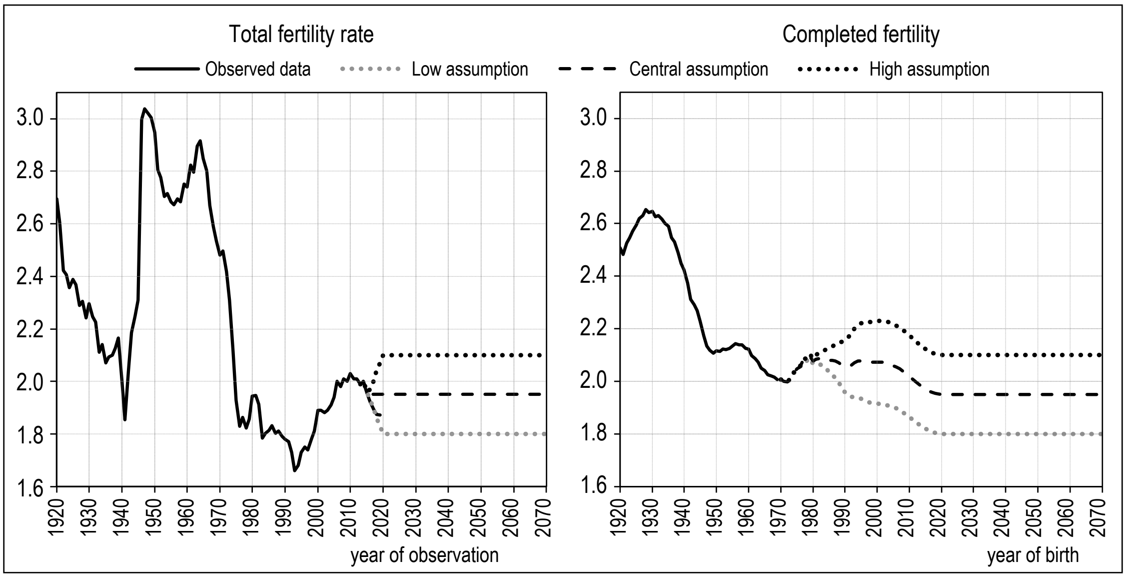
Low and high assumptions are considered for each of the components. The low assumption for mortality assumes that mortality rates will decrease at a lower rate than in the past, while the high assumption assumes that it will fall at a faster rate. The age-specific mortality rates are multiplied by the same coefficient so that the low and high assumptions lead to a life expectancy of plus or minus 3 years compared to the central assumption in 2070, i.e. between 87 and 93 years for men and between 90 and 96 years for women (Figure IV). An assumption for life expectancy that is constant and at the 2014 level, i.e. 79 years for men and 85 years for women, completes these three assumptions. In 2019, the life expectancy of men is 79.7 years and that of women 85.6 years in France, which is the level of the low assumption, given the recent slowdown in life expectancy improvements (Papon & Beaumel, 2020).

1.2. Fertility

As with mortality, the central assumption assumes that the age-specific fertility rates will evolve at the same rate as in the past. However, despite steady medical progress over recent decades, the experts agree that the average age at childbirth cannot increase indefinitely, as fertility declines with age. As a result, the trends are not continued to the projection horizon: fertility rates are stabilised once an average age at childbirth considered as a ceiling is reached. The experts were therefore questioned both on the level of fertility, as measured by the total fertility rate or by completed fertility, and on the evolution of the average age at childbirth. The total fertility rate reflects the average number of children a woman would bear if she knew the fertility conditions in a given year throughout her entire fertile life. It measures women's fertility level at a given moment. Completed fertility is the average number of children born by women of the same generation. It can therefore be calculated when they reach the end of their fertile life, i.e. at the age of 50.

Breaking a historical downward trend, the total fertility rate rose sharply from 1941, marking the beginning of the baby boom (Figure V). This ended in the 1970s: in 1976, the total fertility rate was only 1.83 children per woman, compared to around 2.48 still in 1970, for example. The total fertility rate then remained in a range from 1.8 to 2.0, except around 1993 when it was low (1.66) due to a temporary postponement of the birth schedule for generations born in the early 1970s, apparently linked to poor economic conditions (Pison, 2017). Earlier projections therefore used a central assumption within this range: 1.8 children per woman on three occasions in 1986, 1995 and 2003, then 1.9 children in 2006 and 1.95 in 2010 (Blanchet & Le Gallo, 2014). Assumptions of 1.90 and 1.95 children per woman in the last three projections (2006, 2010 and 2016) confirm and continue the high fertility of the years 2004-2014. Since then, fertility has fallen slightly, but this development is not (yet) taken into account in the projections. Completed fertility decreased overall from the generation born in 1930, of childbearing age throughout the baby boom period (2.6 children on average) to the generation born in 1970 (2.0 children, Figure V). It should increase to 2.1 children for the generation born in 1979, for whom the fertility rates are known up to the age of 40. As for the average age at childbirth, it fell overall from 1901 (29.4 years) to 1977 (26.5 years). Since then, it has been rising constantly, reaching 30.7 years in 2019.

Figure V – **Total fertility rate (on the left) and completed fertility (on the right) according to different assumptions**



Reading Note: In France, the total fertility rate is 1.87 children per woman in 2019. Completed fertility for women born in 1920 is an average of 2.5 children.
Sources and coverage: Insee, population estimates and civil status registry statistics from 1920 to 2019; Insee, population projections from 2013 to 2070. Metropolitan France for years up to 1993, France excluding Mayotte from 1994 to 2013, France from 2014 onwards.

The majority of experts have approved a ceiling on the average age at childbirth at 32 years, a total fertility rate stable at 1.95 and completed fertility of close to 2 children per woman. A total fertility rate stable at 1.95 with a ceiling of 32 years for the average age at childbirth results in completed fertility of 2.06 for the generations born between 1990 and 2005 and 1.95 for the generations born in 2020 and beyond (Figure V). In practice, the fertility rates are continued at each age according to the trend observed between 2009 and 2013. The ceiling for the average age at childbirth (32 years) is reached in 2040. A slight correction coefficient is applied for each year until 2040 in order to set the total fertility rate at 1.95, the target value approved by the experts. From 2040, the age-specific fertility rates are kept constant until 2070.

The low and high assumptions differ from the central assumption only in respect of fertility intensity and not its timing. While there was a broad consensus to have low and high assumptions for symmetrical total fertility rate compared to the central assumption, there was some debate on the setting of the bounds of the variants. We used + or - 0.15 children compared to the central assumption, which makes it possible to use the generation replacement threshold (2.1) as the high value, with the low assumption being a total fertility rate of 1.80 (Figure V). A fertility assumption in line with the EU average, with a total fertility rate of 1.6, was also constructed. In practice, within these variants, the total fertility rate reaches its target value in 2020 and stabilises after that date. In 2019, the total fertility rate is 1.87 children per woman in France, which fits between the low (1.80) and central (1.95) assumptions.

1.3. Migration

As in previous projection exercises, the migration assumptions relate to net migration by sex and age. This is measured indirectly by the difference between the population change between two successive censuses and the natural balance (births – deaths), using data taken from the civil status registry:

$$\textit{Net Migration}_n = (Pop_{n+1} - Pop_n) - (\textit{Natural Balance}_n)$$

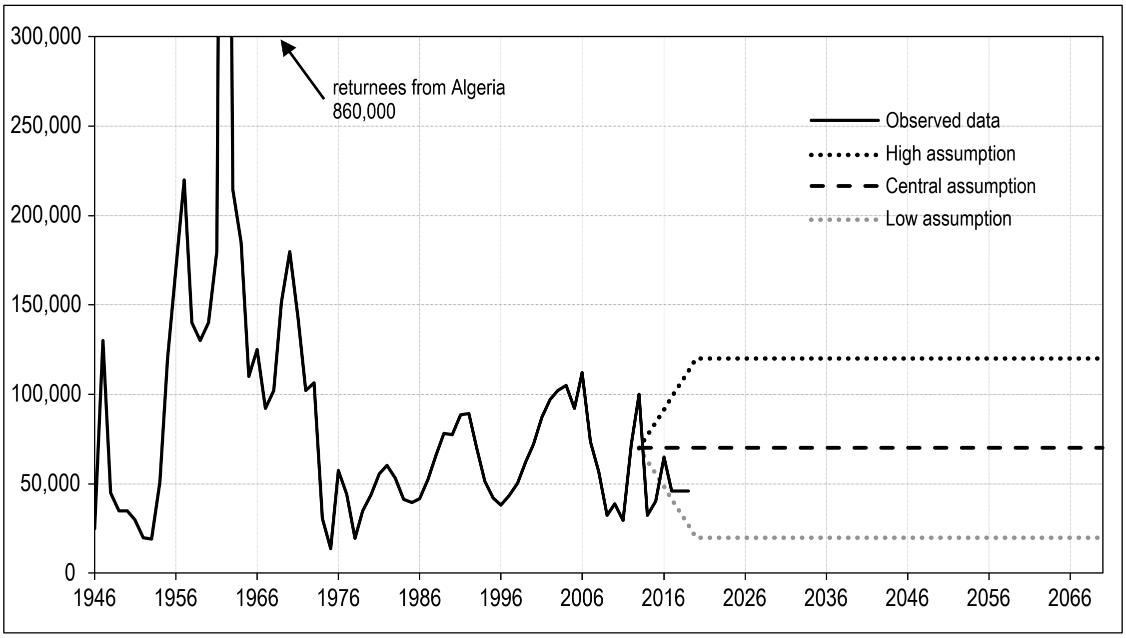
Until the 1980s, the central assumption of the projections reflected the “stated or assumed choices of the planner or migration policy”: an assumption based on the objectives of the economic development plans in the 1960s and 1970s, then the assumption of zero net migration in the 1979 and 1986 projections, in line with the policy of closing the borders to immigration from 1973 (Blanchet & Le Gallo, 2014). Subsequent projections are based more on past trends, allowing for results closer to the observed data. The central migration assumption of this projection exercise uses net migration of 70,000 people per year. This level is fairly close to the average calculated over different past periods (Figure VI). The structure by sex and age is assumed to be stable and corresponds to the average observed over the 2006-2012 period. However, some experts have highlighted the value of modifying this method by focusing on the flows of immigrants and emigrants by sex and age and no longer on net migration. Indeed, net migration is the result of movements of populations that are very diverse in terms of their motivations and migration history, their age and their profile at the time of migration. The people who make up the flow of immigrants are foreigners on arrival, who have various statuses (students, refugees, spouses of French nationals, etc.), in addition to French citizens returning or coming to live in France, whether they were born abroad or left to live abroad. On the emigration side, again, the motivations and ages are diverse. Unfortunately, it has not been possible to fully take into account this recommendation. Indeed, the flow of immigrants by sex and age is known in annual census surveys, thanks to a question on previous place of residence. In contrast, there are no comprehensive statistics that allow for the direct recording of flows of emigrants (Brutel, 2015). Emigration can only be estimated based on the difference between immigration and net migration:

$$\textit{Exits}_n = \textit{Entries}_n - \textit{Net migration}_n$$

Emigration therefore combines uncertainties associated with the estimation of immigration and those associated with net migration, which makes it difficult to breakdown by sex and age. The assumptions therefore relate to net migration by sex and age, the figures for which are more robust than emigration by sex and age.

Compared to the central assumption, the low and high assumptions differ by 50,000 people per year upwards or downwards (Figure VI). Net migration would therefore be between 20,000 and 120,000 people per year. It varies greatly from year to year, but has remained within this range between 1979 and 2016 (Figure VI). In 2016, the last year for which figures are known, net migration is 65,000 people (Papon & Beaumel, 2020), which is close to the central assumption (70,000).

Figure VI – **Net migration according to different assumptions**



Reading Note: In France, net migration is 46,000 people in 2019.
Sources and coverage: Insee, population estimates and civil status registry statistics from 1946 to 2019; Insee, population projections from 2013 to 2070. Metropolitan France for years up to 1993, France excluding Mayotte from 1994 to 2013, France from 2014 onwards.

2. Analysis of the Projections: Robustness and Fragility

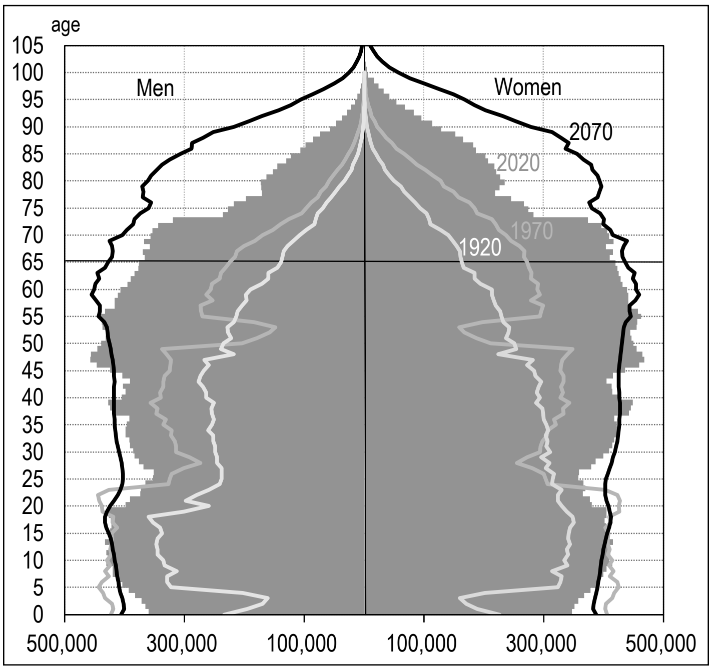
If recent demographic trends were to continue, France would have 76.4 million inhabitants in 2070, which is 9.4 million more than in 2020 (Table 1). Most of this increase would come from the elderly, defined here as those aged 65 or over (+8.2 million). This ageing of the population is not a new phenomenon. At the beginning of the 20th century, the age pyramid was aptly named: its base was wide and its top was pointed. It has gradually changed and now looks more like an "age cylinder" (Pison, 2009 and Figure VII). Indeed, the number of elderly has almost doubled every 50 years: 3.5 million elderly in 1920, 6.5 million in 1970 and 13.8 million in 2020. It could reach 21.9 million in 2070, according to the central scenario. However, the rate of growth up to 2070 would be lower than in the past: the number of elderly would increase "only" by a factor of 1.6 between 2020 and 2070, whereas it increased by a factor of 2.1 between 1970 and 2020 and 1.8 between 1920 and 1970. This

Table 1 – **Population and proportions by age in 1920, 1970, 2020 and 2070 (central scenario)**

	Metropolitan France			France		Metropolitan France		France
	1920	1970	2020	2020	2070	Evolution 1970/1920	Evolution 2020/1970	Evolution 2070/2020
Population (in thousands)								
Aged 0-19	11,999	16,748	15,390	16,085	16,262	40%	-8%	1%
Aged 20-64	22,841	27,306	36,055	37,228	38,243	20%	32%	3%
Aged 65 or over	3,543	6,474	13,453	13,751	21,944	83%	108%	60%
Total	38,383	50,528	64,898	67,064	76,448	32%	28%	14%
Proportion (as a %)								
Aged 0-19	31	33	24	24	21	6%	-28%	-11%
Aged 20-64	60	54	56	56	50	-9%	3%	-10%
Aged 65 or over	9	13	21	21	29	39%	62%	40%
Total	100	100	100	100	100			
Youth indicator (Aged 20-64/65 or over)	*6.4*	*4.2*	*2.7*	*2.7*	*1.7*	*-35%*	*-36%*	*-36%*

Reading Note: In 2070, France is expected to have 21,944,000 inhabitants aged 65 or over, according to the central scenario.
Sources and coverage: Insee, population estimates and civil status registry statistics in 1920, 1970 and 2020; Insee, central population projection scenario in 2070. Metropolitan France in 1920, 1970 and 2020, France in 2020 and 2070.

Figure VII – **Age pyramid for France in 1920, 1970, 2020 and 2070 (central scenario)**



Reading Note: In 2020, France has 419,000 women aged 65.
Sources and coverage: Insee, population estimates and civil status registry statistics in 1920, 1970 and 2020; Insee, central population projection scenario in 2070. Metropolitan France in 1920 and 1970, France in 2020 and 2070.

increase since 1920 is mainly the consequence of the increase in life expectancy. Each individual is more likely to become an elderly person than an individual of the generation born fifty years earlier. For example, 45% of men born in 1905 reached the age of 65 (in 1970), 76% of men born in 1954 reached this age in 2019 and virtually all (95%) men born in 2005 could live to become elderly in 2070.

In order to study ageing, it is necessary to look not only at the elderly, but also at younger people: indeed, the population ages if the number of young people increases less quickly than the number of elderly. A traditional indicator is the number of people aged between 20 and 64, which largely corresponds to the working ages, compared to the number of elderly, which mainly covers retired people. This ratio has been declining since 1920, indicating that the number of people aged 20 to 64 is increasing less quickly than the number of elderly and, therefore, that the population is ageing: from 6.4 people aged 20 to 64 per elderly person in 1920, the ratio fell to 4.2 in 1970, then 2.7 in 2020 and could be 1.7 in 2070 (Table 1).

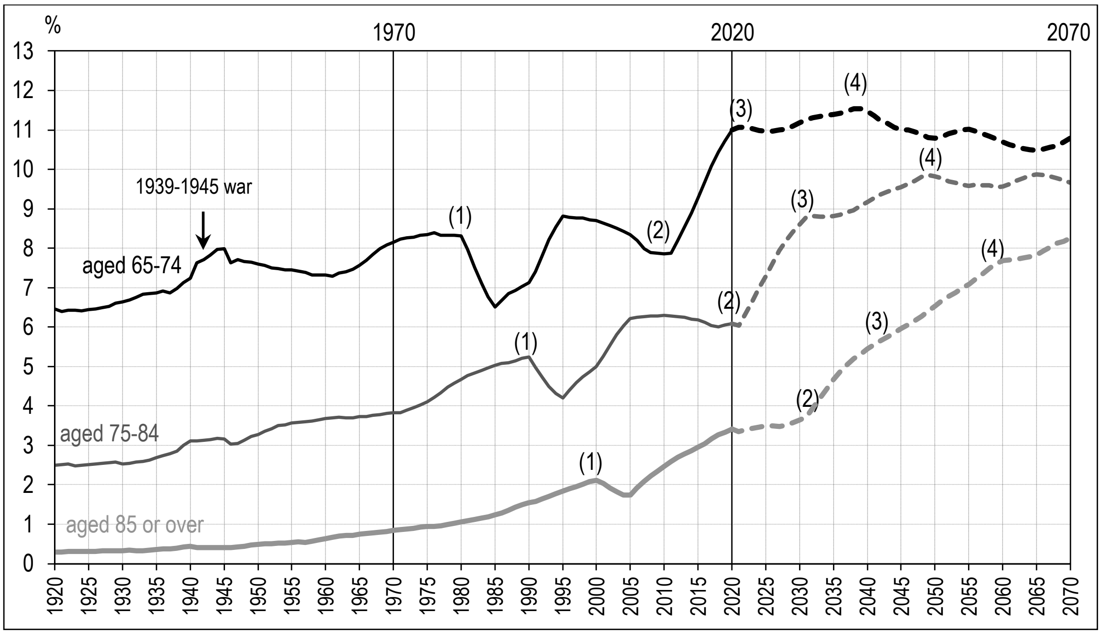
The rate of ageing, measured by the decline in the ratio of people aged 20 to 64 to those aged 65 or over, is expected to be similar over the next 50 years to that observed in the past (-36%, see Table 1). Some of the baby boom generations have already become elderly before 2020 (those aged between 65 and 73 on 1 January 2020). In contrast, the increase in the number of people aged 65 and over is expected to slow from 2040 onwards, by which time the last generation of the baby boomers will be over 65.

2.1. Between Now and 2070, Population Ageing Driven by the Eldest

The proportion of "young" elderly, aged 65 to 74, is expected to be virtually stable until 2070, close to 11% over the entire period (Figure VIII). It has increased since 2011, when the larger baby boom generations, born between 1946 and 1974, began to reach 65 years of age. From 2021, the people aged 65 to 74 will all have been born after the baby boom and the proportion of them within the population is expected to change little.

Only the eldest, aged 75 or over, are expected to contribute to the ageing of the population, as the first baby boom generation has not yet reached this age in 2020. The increase in the proportion of people aged 75 to 84 within the population is therefore expected to accelerate from 2021, with the increase in the proportion of people aged 85 years or older accelerating from 2031. Once each age group includes only generations born after the start of the baby boom, the ageing is expected to continue due to the rise in life expectancy, but at a slower rate, up to 2050 for those aged 75 to 84 (at which point their proportion within the population is expected to

Figure VIII – **Proportion of elderly people by age group and year**



Reading Note: In 2020, France has 11% of its population aged 65 to 74.
Notes: (1) Start of the arrival of the baby bust generations born 1915-1919; (2) Start of the arrival of the baby boom generations; (3) End of the arrival of the baby boom generations; (4) Death of the baby boom generations.
Sources and coverage: Insee, population estimates and civil status registry statistics from 1920 to 2020; Insee, central population projection scenario from 2021 onwards. Metropolitan France for years up to 1990, France excluding Mayotte from 1991 to 2013, France from 2014 onwards.

reach 9.8%) and up to 2060 for those aged 85 or over (at which point their proportion within the population is expected to reach 7.7%). Next, the effect of the increase in life expectancy on ageing should slow down with the death of the last baby boom generations: the proportion of people aged 75 to 84 is expected to stabilise at the end of the period (at 9.7%) and that of those aged 85 or older is expected to continue to rise (up to 8.2%).

The increase in life expectancy for more than a century in France has been accompanied by a coming together of ages at death. Under the 1920 mortality conditions, ages at death are highly variable: for women, 10% of deaths occur before the age of 1 year, 80% between the ages of 1 and 84 and 10% after the age of 84 (Table 2). Therefore, the age range within which 80% of deaths occur is 83 years. Under the 1970 mortality conditions, that age range is just 34 years, with 10% of deaths occurring before the age of 57 and 10% after the age of 91. This coming together of the ages at death has been achieved in particular thanks to an especially marked drop in mortality between birth and the age of 35. This is still continuing today: year after year, on average, deaths are occurring later and later and at ever closer ages (Figure IX). According to the central projection scenario, this coming together will continue: under the 2070 mortality conditions for women, 80% of deaths are expected to take place between the ages of 83 and 102.

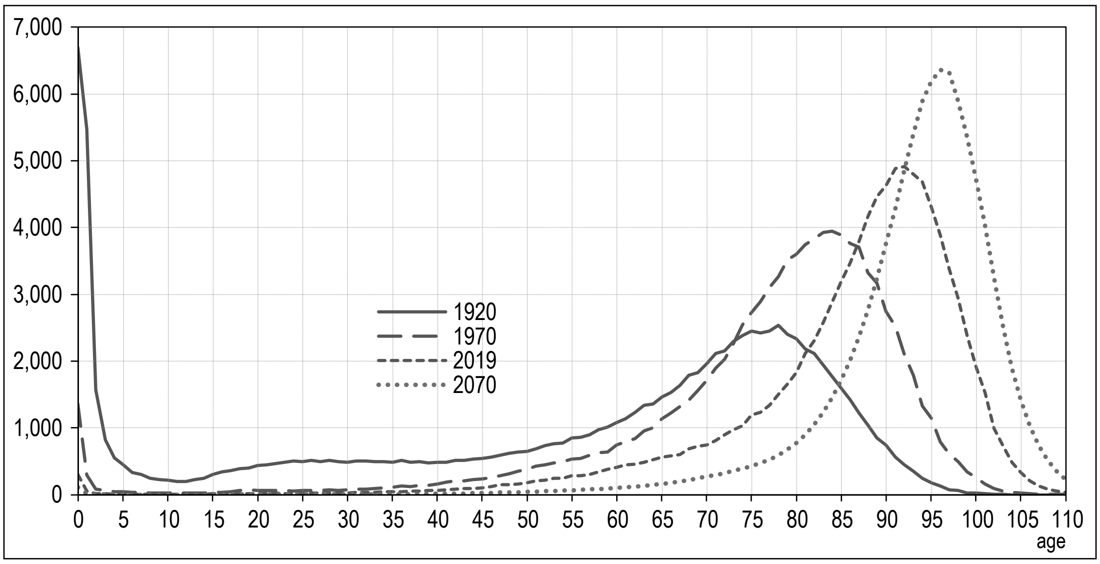
Table 2 – **Age before which 10%, 50% and 90% of men or women would have died under the mortality conditions of a given year**

(In years)

	Men				Women			
	10%	50%	90%	Interdecile range	10%	50%	90%	Interdecile range
1920	1	60	81	80	1	65	84	83
1970	47	72	87	40	57	80	91	34
2019	60	84	95	35	69	89	98	29
2070	78	92	100	22	83	95	102	19

Notes: These are deaths for a fictitious generation subject to the mortality conditions of a given year.
Reading Note: Under the 1920 mortality conditions, 10% of men would die before the age of 1 and 90% would die before the age of 81, giving an interdecile range of 80 years.
Sources and coverage: Insee, population estimates and civil status registry statistics from 1920 to 2019; Insee, central population projection scenario in 2070. Metropolitan France in 1920 and 1970, France in 2019 and 1970.

Figure IX – **Distribution of women's deaths under mortality conditions of a given year, per 100,000 deaths**



Reading Note: Under the 2019 female mortality conditions, 4,900 deaths would have occurred at the age of 92 (out of a total of 100,000 deaths).
Sources and coverage: Insee, population estimates and civil status registry statistics from 1920 to 2019; Insee, central population projection scenario from 2070 onwards. Metropolitan France in 1920 and 1970, France in 2019 and 2070.

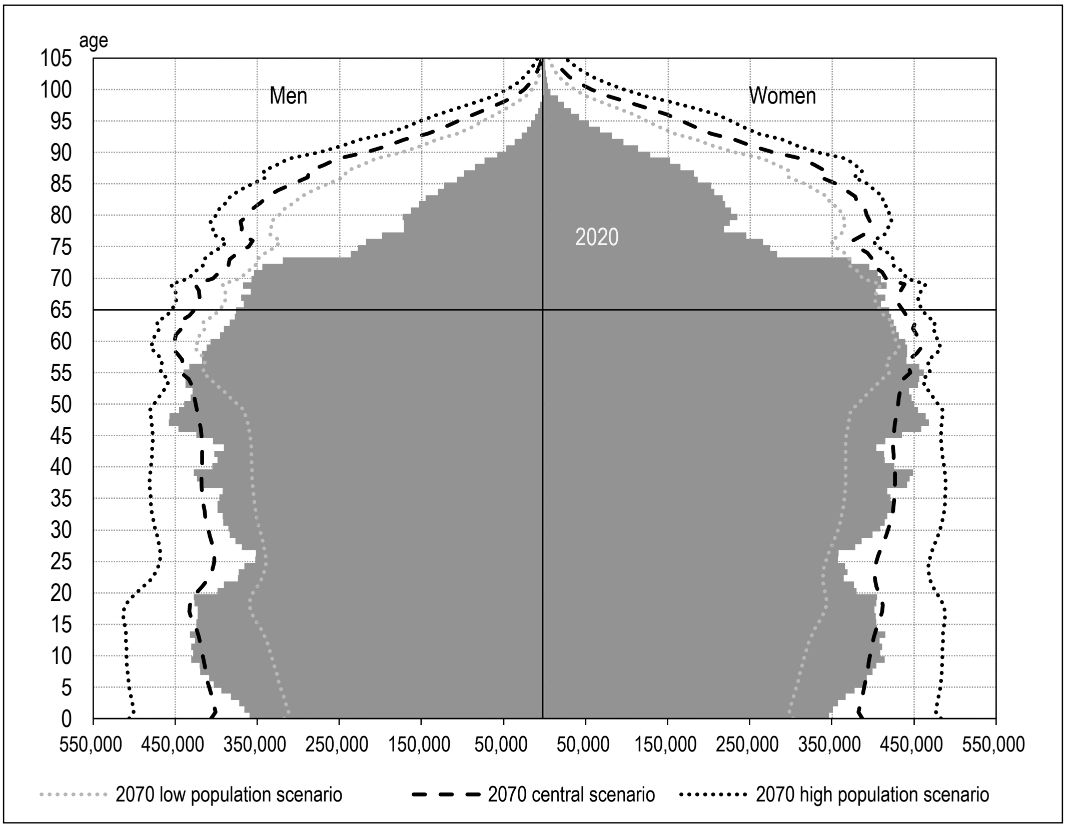
For men, the ages at death have also been moving closer together since 1920 and this trend is also expected to continue. For example, the age range in which 80% of deaths occur has been reduced from 40 years under the 1970 mortality conditions to only 35 years under those of 2019. Furthermore, in 2019, the spread of ages at death is greater for men than for women, but this gap is expected to narrow by 2070.

2.2. Uncertainty over the Evolution of Population Figures

While ageing in the coming years seems inevitable, the size of the population is uncertain. This is especially true for people under the age of 55 in 2070, virtually all of whom have not yet been born (Figure X), and neither have the mothers of the babies of 2070 – only their grandmothers have been. The projection for the number of people under the age of 55 is based on the number of women of childbearing age, their emigration from and immigration to French territory, and the evolution of fertility rates. However, unlike mortality, which generally shows a downward trend, there is no real medium-term trend concerning fertility, at least in countries such as France, which completed their demographic transition several decades ago (Vallin, 2002). The future evolution of the total fertility rate is therefore difficult to estimate. According to Eurostat data, fertility has generally declined in recent years in countries that had high fertility rates, and in some cases the decline has been very fast. For example, Finland, one of the most fertile countries in Europe with a total fertility rate of 1.87 in 2010, is now below the European average with a total fertility rate of 1.41 in 2018 (OSF, 2019). In France, the total fertility rate has also fallen recently, but less sharply: it fell from 2.0 in 2010 to 1.86 in 2019 for France excluding Mayotte (Beaumel & Papon, 2020).

In 2070, depending on whether all the assumptions are combined downwards or upwards, the number of people aged under 55 is expected to be between 38.3 million and 53.3 million, which is between -16% and +17% compared to the central scenario (Table 3). Births are expected to number between 643,000 and 1,013,000, which is -21% and +24% compared to the central scenario. If France were to have a lower fertility level in the future, close to the European average, this would lead to 35.9 million people aged under 55, which is -21% compared to the central scenario. There is less uncertainty over the total number of people aged 55 or older than over the number of people who have not yet reached that age. Those aged over 55 in 2070 have already been born, as they are the people aged under 60 at present who will survive until that date and will stay or settle in France. The number of people aged 55 or over would be between 27.8 million and 34.4 million, which is between -10% and +11% compared to the central scenario, depending on whether all assumptions are combined downwards or upwards. Only the scenario in which life expectancy remains at its 2014 level would lead to a more significant change, -20% compared to the central scenario.

Figure X – **Age pyramid for France in 2020 and 2070**
Central scenario, low and high population scenarios



Reading Note: In 2020, France has 419,000 women aged 65.
Sources and coverage: Insee, population estimates and civil status registry statistics in 2020; Insee, population projections in 2070. France in 2020 and 2070.

Table 3 – **Population by age (in millions) for various scenarios in 2070 and difference (in %) from the central scenario**

		Low population	Central scenario	High population	Constant life expectancy	EU fertility	Immigration equal to emigration
Aged 0-54	Population	38.3	45.6	53.3	45.0	35.9	41.3
	Difference	-16%		17%	-1%	-21%	-9%
Aged 55 or over	Population	27.8	30.9	34.4	24.8	30.9	28.5
	Difference	-10%		11%	-20%	0%	-8%
Aged 55-64	Population	8.4	8.9	9.4	8.4	8.9	8.0
	Difference	-6%		6%	-6%	0%	-11%
Aged 65-74	Population	7.6	8.2	8.8	7.3	8.2	7.7
	Difference	-7%		7%	-11%	0%	-7%
Aged 75-84	Population	6.7	7.4	8.1	5.8	7.4	6.8
	Difference	-9%		9%	-22%	0%	-8%
Aged 85-94	Population	4.2	5.1	6.1	2.9	5.1	4.8
	Difference	-17%		21%	-43%	0%	-5%
Aged 95 or over	Population	0.8	1.2	2.0	0.4	1.2	1.2
	Difference	-32%		60%	-66%	0%	1%
Total	Population	66.1	76.4	87.6	69.8	66.8	69.8
	Difference	-14%		15%	-9%	-13%	-9%

Notes: In the EU fertility scenario, the total fertility rate of 1.6 children per woman from 2020 onwards.
Reading Note: According to the high population scenario, France would have 53.3 million inhabitants aged 54 or under in 2070.
Sources and coverage: Insee, population projections in 2070. France.

As for the total population residing in France, how it will evolve is uncertain. According to the low population scenario, the population would increase until around 2040, before decreasing and ending up just slightly higher in 2070 than in 2020 (Figure XI). In contrast, according to the high population scenario, the population would maintain a strong growth rate and reach 87.6 million in 2070, which is 20.6 million higher than in 2020.

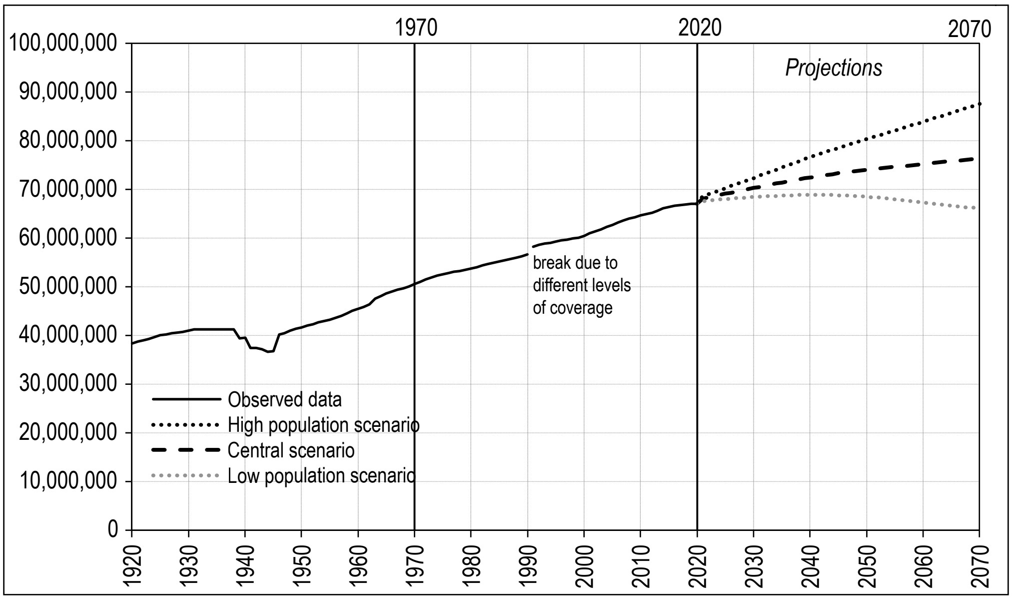
The central population projection scenario assumes that past trends will continue. Life expectancy at birth, for men, would then increase from 80 years in 2019 to 90 years in 2070, while for women it would increase from 86 to 93 years. To what extent does ageing depend on assumptions regarding life expectancy? To answer this question, we can analyse what would happen if life expectancy were not to increase. We assume that it remains at its 2014 level until 2070. However, in such a case, the population would age between 2020 and 2040: the difference compared to the central scenario and the scenario with constant life expectancy is relatively small (Figure XII). The proportion of elderly people would then increase from 20.5% to 24.5%, which is an increase fairly close to that of the central scenario (from 20.5% to 26.1%). Similarly, the ratio between the number of people aged 20 to 64 and those aged 65 or over would fall from 2.7 to 2.2 in 2040, compared to a decrease from 2.7 to 2.0 in the central scenario (Figure XIII). Thus, until 2040, ageing depends relatively little on the expected improvements in life expectancy. This is mainly a consequence of the past, i.e. the improvement of life expectancy that has already occurred and the continuation of the numerous baby boom generations living beyond the age of 65.

Beyond 2040, the constant life expectancy scenario does not call into question the increase in the number of elderly people aged 65 or over, but the assumptions used play a greater role. In 2070, the difference between the central scenario and the constant life expectancy scenario is more marked than in 2040 (Figure XII). Similarly, the evolution of the ratio between the number of people aged 20 to 64 and the number of elderly people is sensitive to the selection of assumptions: it would stabilise if life expectancy remained at its 2014 level, while it would decrease in the central scenario, albeit at a slower rate than in the past (Figure XIII).

2.3. The Ageing of the Population Depends on the Indicator Used

To study ageing, chronological age is often used, with a given fixed threshold, such as 65 years, for example. Another approach, using "prospective" age, i.e. the number of years left to live rather than the number of years already lived (Sanderson & Schervov, 2007), has been developed in particular in Belgium (Vandresse, 2020) and in Great Britain (Spijker & MacInnes, 2013).

Figure XI – **Observed and projected population under different scenarios**

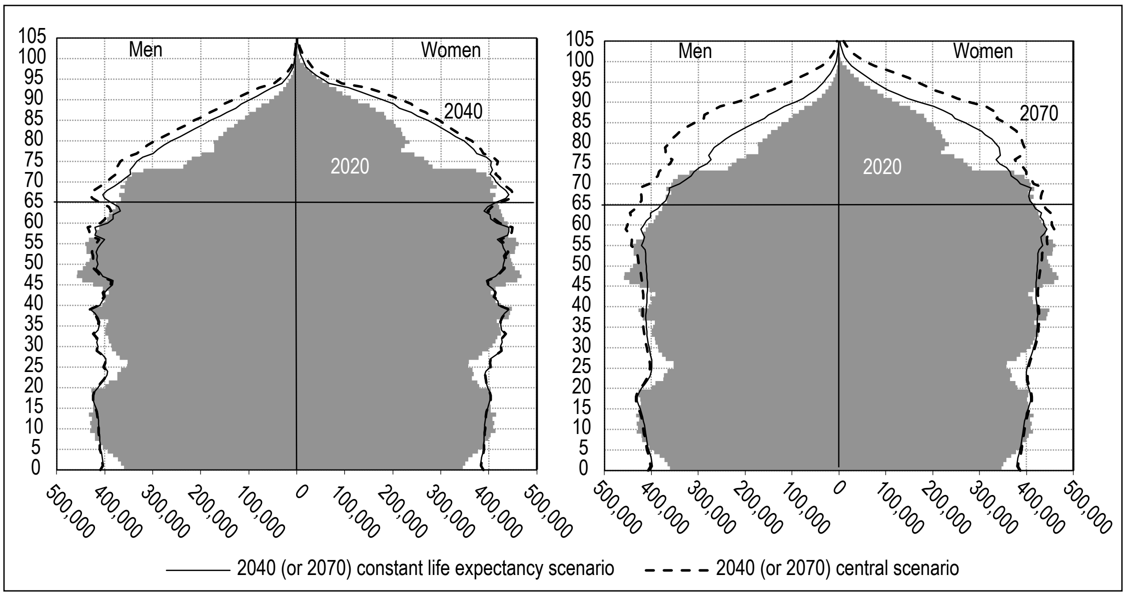


Reading Note: According to the central projection scenario, France would have 76.4 million inhabitants in 2070.
Sources and coverage: Insee, population estimates and civil status registry statistics from 1901 to 2020; Insee, population projections from 2021 onwards. Metropolitan France for years up to 1990, France excluding Mayotte from 1991 to 2013, France from 2014 onwards.

The previous analysis using chronological age, with a threshold at age 65, shows that the population of France has aged and that this phenomenon is expected to continue until 2070. What is the result when using prospective age? In this approach, the ageing indicator is calculated by dividing the number of people aged between 20 and the age at which life expectancy is 22 years by the number of people who are over that age and who, therefore, have a life expectancy of less than 22 years:[7]

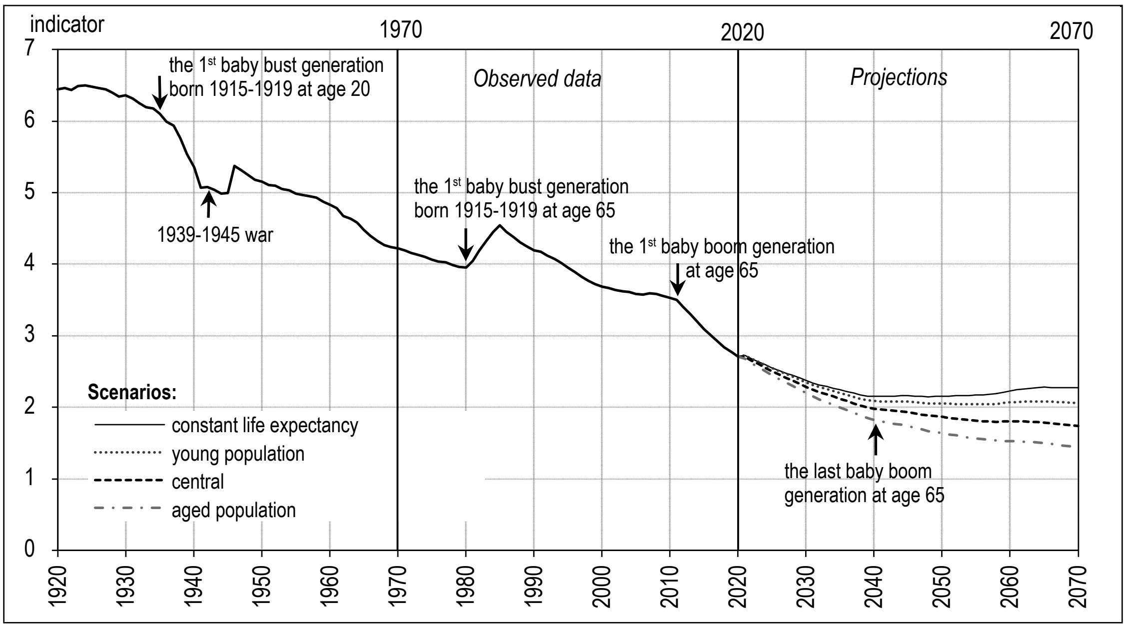
7. The threshold of 22 years has been chosen as that is the life expectancy at the age of 65 in France in 2019.

Figure XII – **Age pyramid in 2020 and 2040, and in 2020 and 2070**
Central scenario and constant life expectancy scenario



Reading Note: In 2020, France has 419,000 women aged 65.
Sources and coverage: Insee, population estimates and civil status registry statistics in 2020; Insee, population projections in 2040 and 2070. France.

Figure XIII – **Youth indicator[(a)]**



(a) Ratio of people aged 20 to 64 to elderly people aged 65 or over.
Notes: The young population scenario combines the assumptions of low life expectancy, high fertility and high migration, whereas the aged population scenario combines the opposite assumptions.
Reading Note: According to the central projection scenario, France would have 1.7 people aged 20 to 64 for each elderly person in 2070.
Sources and coverage: Insee, population estimates and civil status registry statistics from 1901 to 2020; Insee, population projections from 2021 onwards. Metropolitan France for years up to 1990, France excluding Mayotte from 1991 to 2013, France from 2014 onwards.

Using chronological age: $\frac{Pop\ 20\ to\ 64\ years\ old}{Pop\ 65\ years\ or\ over}$

Using prospective age: $\frac{Pop\ 20\ to\ x\ years\ old}{Pop\ x\ years\ or\ over}$

where *x* is the exact age (in years and months) at which life expectancy is 22 years for men or women. The age *x* therefore varies by year and sex.

Using this indicator, France has "become younger" since 1920: it had 1.8 people with a life expectancy of over 22 years per person with a lower life expectancy (Table 4). This ratio reached 2.1 in 1970 and 2.8 in 2020. This becoming younger can be explained by the strong increase in the number of people with a life expectancy of over 22 years, combined with a slight increase in the number of people with a lower life expectancy. By 2070, according to the prospective approach, France should neither become younger nor older: the ratio would be 2.7, which is almost the same level as in 2020.

Thus, the ageing of the population depends on the indicator used. Using the number of years lived, France will age and is expected to continue to age according to the central scenario. Using the number of years left to live, France has become younger and should neither age nor become younger between now and 2070. The selection of the most appropriate indicator depends on the purpose of the study and the assumptions used. For example, when studying the evolution of the number of people of dependent age, chronological age will be the more appropriate indicator if healthy life expectancy is assumed to be stable, whereas prospective age will correspond better to healthy life expectancy assumed to evolve at the same rate as life expectancy.

3. France and its EU Neighbours

The population projections published by Eurostat (Eurostat, 2019) make it possible to compare France's situation with that of its European neighbours. These projections are not a simple compilation of the national projections made by each country, but are a different exercise, with a common methodology for all countries of the 28-member EU, as well as for Iceland, Norway and Switzerland.[8] The advantages of selecting a common method rather than compiling national projections are: the absence of missing data for some countries that do not yet produce projections; easy access to documentation and results; and the elimination of bias associated with each country's varying degrees of optimism, which facilitates comparisons. The downside of this method is the inevitable discrepancy between Eurostat's projections and those carried out by the countries' national institutes. This discrepancy can lead to communication problems and questions regarding the data to be selected by users.

Like Insee, Eurostat uses the component method and a deterministic approach to establish the reference scenario. For each of the components, Eurostat uses as a basis a continuation of past trends and an assumption of convergence of demographic dynamics within Europe, which is based on the idea that socio-economic differences between EU countries are bound to narrow. As time progresses, the use of the continuation of past trends gives way to the use of the assumption of convergence. Convergence is partially achieved in 2100, the European projection horizon. The total fertility rate is thus projected to rise everywhere except in France, the country with the highest fertility in 2018, where it remains almost stable. The total fertility rate increases more in low-fertility countries, allowing for convergence. Life expectancy is projected to rise in all countries, with those with low life expectancy making more gains than others. Net migration increases in countries where it is negative and falls in countries where it is strongly positive, which also allows for convergence.

8. *United Nations (UN) projections are also based on a common methodology, rather than a compilation of national projections. They use a probabilistic approach (Costemalle, 2020).*

Table 4 – **Population (in thousands) in 1920, 1970 and 2020 and evolutions according to prospective age**

	Metropolitan France			France		Metropolitan France		France
	1920	1970	2020	2020	2070	1970/1920	2020/1970	2070/2020
Population aged 20 to *x* (a)	17,085	22,915	36,377	37,558	44,083	34%	59%	17%
Population aged *x* or older (b)	9,300	10,865	13,131	13,421	16,104	17%	21%	20%
Total	26,384	33,780	49,508	50,979	60,187	28%	47%	18%
Youth indicator (a/b)	1.8	2.1	2.8	2.8	2.7	15%	31%	-2%

Reading Note: In 2070, France has 44,083,000 inhabitants aged 20 to *x*, with *x* being the exact age at which life expectancy is 22 years for men or women.
Sources and coverage: Insee, population estimates and civil status registry statistics in 1920, 1970 and 2020; Insee, central population projection scenario in 2070. Metropolitan France in 1920, 1970 and 2020, France in 2020 and 2070; people aged 20 or over.

Together with the reference scenario, Eurostat provides a scenario with zero net migration for each year projected (with fertility and mortality assumptions identical to those of the reference scenario), so as to better understand the population evolution mechanisms linked to migration.

In their reference scenario, Insee and Eurostat make very similar assumptions about net migration, of around 70,000 people per year on average over the period 2019-2069. The total fertility rate projected by Eurostat for France (1.87 in 2070) is slightly lower than Insee's central assumption (1.95), but remains higher than the low assumption (1.80). It is in respect of mortality that the differences are most marked: according to the Eurostat reference scenario, life expectancy at birth would reach 86.6 years for men and 91.0 years for women in 2070, which is a level close to the low Insee hypothesis (87.1 year and 90.0 years). The difference is linked to the fact that Eurostat carried out its projections more recently than Insee and has thus been able to take greater account of the slowdown in the rise in life expectancy observed since 2014.

According to Eurostat, the 28-member EU would have 509.5 million inhabitants in 2070, only slightly less (-0.8%) than its 513 million inhabitants in 2019 (Table 5). Initially, the population would increase slightly until 2044 (+2.2%), then would decrease to its initial level at the end of the period.

Table 5 – **Population, net migration, total fertility rate and life expectancy at birth according to country of residence**

	Population in 2019 (millions)	Population in 2070 (millions)	Evolution 2019/2070 (%)	Net migration/population 2019-2069 (%)	Total fertility rate in 2070	Life expectancy	
						Men in 2070	Women in 2070
Luxembourg	0.6	1.0	68	0.8	1.62	86.6	90.7
Malta	0.5	0.7	47	0.8	1.61	86.8	90.7
Sweden	10.2	14.5	42	0.5	1.81	86.7	90.1
Cyprus	0.9	1.2	33	0.5	1.53	86.4	89.7
Iceland	0.4	0.5	30	0.3	1.76	86.9	90.2
Ireland	4.9	6.1	25	0.2	1.79	86.7	90.3
UK	66.6	82.1	23	0.3	1.81	86.3	89.9
Norway	5.3	6.5	22	0.4	1.69	86.8	90.3
Switzerland	8.5	10.4	22	0.4	1.64	87.2	90.8
Denmark	5.8	6.6	14	0.3	1.79	86.1	89.8
Belgium	11.5	12.9	13	0.3	1.73	86.2	90.2
Austria	8.9	9.9	12	0.4	1.68	86.2	90.1
France	67.0	72.0	7	0.1	1.87	86.6	91.0
Spain	46.9	48.4	3	0.4	1.52	86.9	91.1
Netherlands	17.3	17.4	1	0.2	1.70	86.5	89.8
UE28	513.5	509.5	-0.8	0.2	N/A	N/A	N/A
Germany	83.0	80.6	-3	0.3	1.71	86.0	89.9
Czech Rep.	10.6	10.2	-4	0.2	1.77	84.8	89.1
Finland	5.5	5.3	-5	0.2	1.62	86.0	90.4
Slovenia	2.1	1.9	-9	0.2	1.74	85.7	90.1
Estonia	1.3	1.2	-13	0.1	1.76	84.2	89.6
Hungary	9.8	8.5	-13	0.2	1.74	83.6	88.4
Slovakia	5.5	4.6	-16	0.1	1.65	84.1	88.9
Poland	38.0	31.7	-17	0.0	1.67	84.3	89.4
Italy	60.4	50.2	-17	0.3	1.53	86.8	90.6
Greece	10.7	8.5	-21	0.1	1.56	86.3	90.1
Portugal	10.3	8.0	-22	0.1	1.56	85.8	90.3
Romania	19.4	15.1	-22	0.0	1.79	83.5	88.4
Latvia	1.9	1.4	-25	0.0	1.79	82.6	88.5
Croatia	4.1	2.9	-28	0.0	1.59	84.2	88.6
Bulgaria	7.0	4.8	-31	0.0	1.69	83.0	87.7
Lithuania	2.8	1.9	-32	-0.1	1.72	82.9	88.6

Reading Note: According to the Eurostat reference scenario, the 28-member EU would have 509.5 million inhabitants in 2070. In France, net migration compared to the population would be an average of 0.1% per year between 2019 and 2069.
Sources and coverage: Eurostat, demo_pop in 2019 and europop2018 in 2070. 28-Member EU and Iceland, Norway and Switzerland. France includes Mayotte and Saint-Martin.

Why would the population of the EU be virtually the same in 2070 as in 2019? Eurostat projects an increase in the total fertility rate between 2019 and 2070 for all countries except France, where the total fertility rate would remain virtually stable. Nevertheless, it remains below the generational replacement threshold (2.1 children per woman) for all countries and over the entire period. Fertility therefore has a decreasing influence on the evolution of the total population. In contrast, life expectancy would increase between 2019 and 2070 for all countries, which has an increasing influence on the evolution of the population. Do these two effects offset each other? To answer this question, Eurostat has developed a scenario with zero net migration, i.e. with a number of emigrants equal to the number of immigrants. According to this scenario, the EU would have 419.9 million inhabitants in 2070, which is a decrease of 18% compared to 2019 (Table 6). The increase in life expectancy would therefore not offset the fact that total fertility rate is below the generational replacement threshold. In contrast, in the reference scenario, Eurostat projects positive average net migration over the 2019-2069 period for almost all countries except Lithuania, Latvia and Romania. It would therefore be this migration that would partly explain the stability of the EU population. The migration would combine with increased life expectancy to compensate for low fertility. The virtual stability of the EU population masks disparities between countries. Some countries could see their populations grow, sometimes sharply, mainly those located in Northern or Western Europe, while others could see their population decrease, generally those located in the East (Table 5).

The EU population is expected to age by 2070: the number of elderly, driven by the increase in life expectancy, would increase sharply (+45%), while the number of younger people would fall, -8% for those under 20 and -14% for those aged 20 to 64. Therefore, the ratio between the number of people aged 20 to 64 and those aged 65 or over would fall: from 3.0 in 2019 to 1.8 in 2070. As in France, the ageing of the European population is not a new phenomenon. In the 27-member EU,[9] the ratio has thus fallen from 4.2 in 1990 to 3.0 in 2019. All countries in the 28-member EU, as well as Iceland, Switzerland and Norway would be affected by population ageing as a result of improved life expectancy combined with low fertility. Eurostat also projects an ageing of the population for France, with the ratio falling from 2.8 to 1.9. However, ageing is slightly more marked in the Eurostat projections (-30%) than

9. Croatia joined the EU in 2003.

Table 6 – **Population (in millions) by age and youth indicator in 2019 and 2070**

	2019	2070	Evolution 2070/2019
28-Member EU (Eurostat – reference scenario)	513.5	509.5	-1%
Aged 0-19	106.6	97.7	-8%
Aged 20-64	304.1	263.0	-14%
Aged 65 or over	102.8	148.8	45%
Youth indicator (Aged 20-64/65 or over)	3.0	1.8	-40%
28-Member EU (Eurostat – zero net migration scenario)	513.5	419.9	-18%
Aged 0-19	106.6	75.1	-30%
Aged 20-64	304.1	207.3	-32%
Aged 65 or over	102.8	137.4	34%
Youth indicator (Aged 20-64/65 or over)	3.0	1.5	-49%
France (Eurostat – reference scenario)	67.0	72.0	8%
Aged 0-19	16.2	15.3	-5%
Aged 20-64	37.3	37.4	0%
Aged 65 or over	13.5	19.3	43%
Youth indicator (Aged 20-64/65 or over)	2.8	1.9	-30%
France (Insee – central scenario)	67.0	76.4	14%
Aged 0-19	16.2	16.3	1%
Aged 20-64	37.3	38.2	2%
Aged 65 or over	13.5	21.9	63%
Youth indicator (Aged 20-64/65 or over)	2.8	1.7	-37%

Reading Note: According to the Eurostat reference scenario, the 28-member EU would have 509.5 million inhabitants in 2070.
Sources: Eurostat, demo_pop in 2019 and europop2018 in 2070 for the 28-member EU; Insee, population estimates and civil registry statistics in 2019 and population projections in 2070 for France.

in the Insee projections (-37%), mainly due to a lower life expectancy assumption (Table 6).

* *
*

The population projections make it possible to describe the long-term future of the population, under certain assumptions. Even though the central scenario of the population projections has no chance of happening exactly as established, it still provides a lot of information. The objective of a projection is to present the most likely assumptions within a range of possibilities. Among all of the scenarios provided, the central scenario is often preferred. The projections highlight this scenario, which continues past trends, and present alternative scenarios that would occur if the rate of evolution of the components were to speed up or slow down. The role of demographers is, in particular, to indicate which results differ greatly between scenarios and which vary only slightly. This role is also to highlight those scenarios that depend mostly on our past and little on our future. Certain demographic phenomena, such as the continued ageing of the population, are already included in the current age pyramid. By comparing different assumptions, the projections make it possible to understand the mechanisms that explain the future evolution of the population.

The benefits of a projection are therefore varied, despite the uncertainties inherent in the exercise, which can result in discrepancies between projections and observed evolutions. Various studies have compared the results of past projections with the actual data for France (Blanchet & Le Gallo, 2014) and for some European countries (Majerus, 2015). In France, for example, the population grew at a faster rate than projected in all exercises between 1986 and 2010. In contrast, the continued ageing of the population had already been anticipated. The ratio of people aged 20 to 59 to those aged 60 or over was projected to be close to its current level as early as 1986. These studies therefore teach us to be cautious and show the need to take into account the sensitivity of the results to different assumptions. ☐

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APPENDIX

EVOLUTION OF THE POPULATION OF FRANCE FROM 1935 TO 1985 ACCORDING TO A PROJECTION BY A. SAUVY

The projection by A. Sauvy

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cette diminution conservent en effet toute leur puissance ou gagnent même en intensité.

Or, voici ce que nous montrent les calculs de M. Sauvy, en ce qui concerne le mouvement et le chiffre de la population :

	Naissances	Décès	Excédent des décès	Population
1935...	638.000	658.000	20.000	41.426.000
1940...	523.000	611.000	88.000	41.249.000
1945...	475.000	601.000	126.000	40.702.000
1950...	452.000	595.000	143.000	40.048.000
1955...	407.000	585.000	178.000	39.270.000
1960...	349.000	578.000	229.000	38.283.000
1965...	280.000	572.000	292.000	37.006.000
1970...	229.000	568.000	339.000	35.447.000
1975...	190.000	566.000	376.000	33.685.000
1980...	155.000	565.000	410.000	31.734.000
1985...	127.000	556.000	429.000	29.645.000

Perspectives en cas de fécondité et de mortalité décroissant au rythme actuel.

Au premier abord la diminution prévue pour le nombre des naissances peut sembler invraisemblable, mais il n'en est plus de même dès que l'on compare ce nombre, pour une année donnée, au nombre des mariages probables en l'année considérée, nombre qui correspond à peu près à celui des naissances enregistrées 25 ans plus tôt, divisé par 2,5 à 3. C'est plutôt le nombre des décès prévu pour 1985 qui pourrait sembler exagérément faible, car il correspond à une mortalité par âge réduite de 65 % pour les hommes et les femmes de moins de 50 ans.

En ce qui concerne la composition par âge de la popu-

Hubert, M., Bunle, H. & Boverat, F. (1937). *The Population of France, its Evolution and its Outlooks.* Paris: Hachette.

Work carried out based on the civil status registry and population estimates

Year	Live births	Deaths [(a)]	Natural balance	Population in the middle of the Year
1935	644,000	662,000	-18,000	41,550,000
1940	561,000	740,000	-179,000	40,690,000
1945	646,000	644,000	2,000	39,660,000
1950	862,000	534,000	328,000	41,829,000
1955	806,000	526,000	280,000	43,428,000
1960	820,000	521,000	299,000	45,684,000
1965	866,000	544,000	322,000	48,758,000
1970	850,000	542,000	308,000	50,772,000
1975	745,000	560,000	185,000	52,699,000
1980	800,000	547,000	253,000	53,880,000
1985	768,000	552,000	216,000	55,284,000

[(a)] The number of deaths for the period 1939-1945 do not include deaths (civilian or military) by acts of war, i.e. approximately 600,000 people: 250,000 military personnel (regular army, prisoners of war and security forces) and 350,000 civilians (deported, shot and victims of land operations and bombings).

Sources and coverage: Insee, Statistics from the Civil Status Registry and Population Estimates. Metropolitan France.