Hagtíðindi
Statistical Series

Population

18 November 2015

Population projections 2015–2065

Summary

Statistics Iceland publishes every year updated short (5 years) and long term (50 years) population projections.

According to the medium projection variant, the Icelandic population will grow, from 329 to 437 thousand persons during the next 50 years, due to both migration and natural increase. The high variant predicts a population of 513 thousand while the low variant projects to 372 thousand inhabitants. The projection variants are built according to different assumptions about economic growth, fertility and migration levels.

The number of births per year will exceed the number of deaths per year during the entire period, for high and medium variants. Life expectancy at birth for both men and women will grow: from 83.5 years in 2015 to 88.5 years in 2065 for women and from 79.5 to 84.3 years for men.

The immigration rates are expected to exceed the emigration rates, which is mainly due to a high level of foreign immigration to Iceland. The number of emigrating Icelandic citizens will continue to be higher than the number of returning citizens.

Population structure is predicted to change as follows:

- **After 2035, the total number of men will become smaller than the total number of women (per year). This effect is due to the difference between men's and women's longevities. The phenomenon has been significantly postponed by the high level of male immigration during the years 2002–2006. The ratio will grow again, around 2050, reflecting the fact that the life expectancy of men will rise with time.**
- **By 2035, 20% of the population will be 65 years and older and by 2061 the percentage will be over 25%.**
- **After 2050, the working age population (defined as 20 to 65 years old) will have to support more people of *older* than *younger* ages.**

Overview

The time span and the projection variants

In this paper, we describe the population development and its structure for the next 50 years. The long time horizon is chosen since the demographic processes are in general very slow and build up to significant effects over decades.

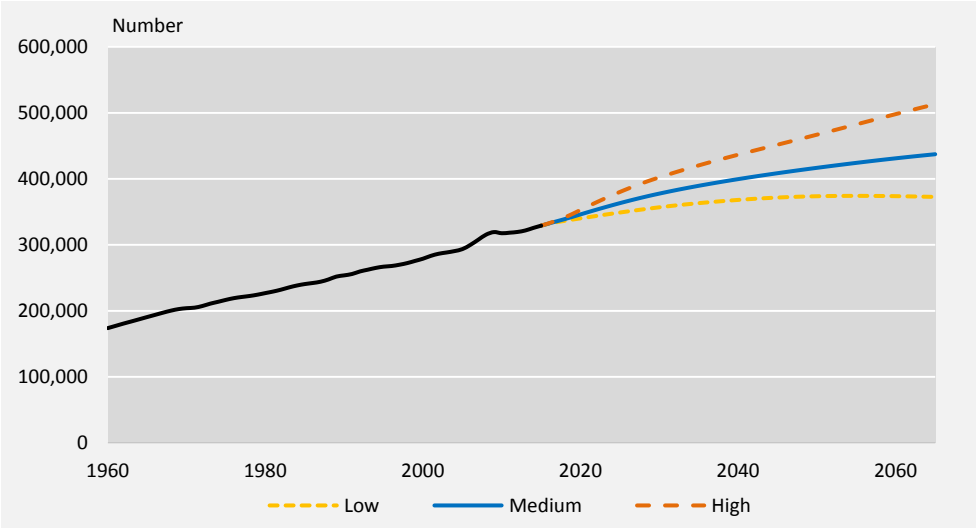
Apart from the main data driven prediction called medium variant, two alternative projections called low and high variants are provided. Appendix 1 explains the way they are constructed. The variants are used in order to analyse the impact of different economic and demographic assumptions on future population development.

They do not provide a measure of uncertainty in the forecasts nor is any attempt made to estimate how likely one or the other of these variants is.

The general methodology is briefly described in appendix 2. Measures of uncertainty and confidence in predicted values are given when these values are based on time series modelling and forecasting. This accounts for the statistical errors but not for the uncertainty in the main qualitative assumptions made regarding future developments.

The population projection results are based on the evolution of the number of births, deaths, immigrants and emigrants per year in the next five decades. These are analysed in more detail in what follows. The population structure and some implications of its change in time are described in the last section of the paper.

Figure 1. Population development 1960–2065



More than half a million people after 2050

The total population of Iceland will continue to grow in the next 50 years, according to the medium and high projection variants. The low variant, based on low fertility and low net migration rates, shows a change in this trend a few years before the end of the forecasting period.

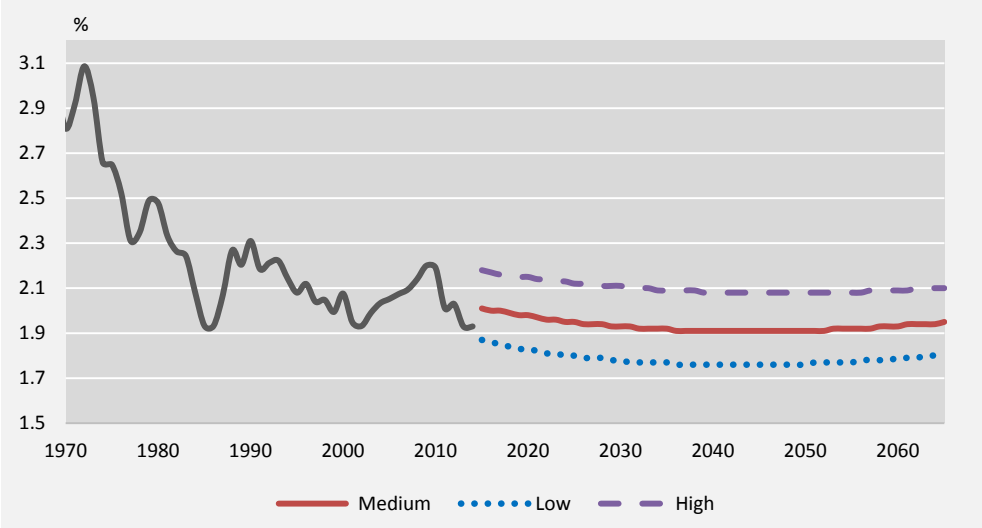
On the 1st of January 2015 the population of Iceland was 329,100. According to the medium projection variant there will be 437,336 inhabitants in 2065, 513,116 according to the high and 372,642 according to the low variant. This amounts to an overall growth for the medium, high and low variants of 56%, 88% and 24%, respectively.

The optimistic variant sees the Icelandic population exceeding half a million inhabitants around 2060 while the pessimistic one predicts a decrease in population after 2055. This is essentially due to dissimilar fertility rates predictions for these two variants, as well as different migration scenarios. The distinct values at the end of the short term (2015–2019) projection variants, 342,590 (medium), 338,370 (low) and 347,064 (high) are primarily the result of differences in assumptions regarding GDP growth and unemployment rates.

Evolution of fertility rates

The age-specific fertility rates are measures of the relative frequency of childbearing among women of different ages within the reproductive years. Using time series methods and known past values of these rates, future values can be predicted. The total fertility rate estimates the number of expected children per woman according to the childbearing patterns thus calculated. This is shown in figure 2 for both past and future 50 years.

Figure 2. Total fertility rate per year 1970–2065



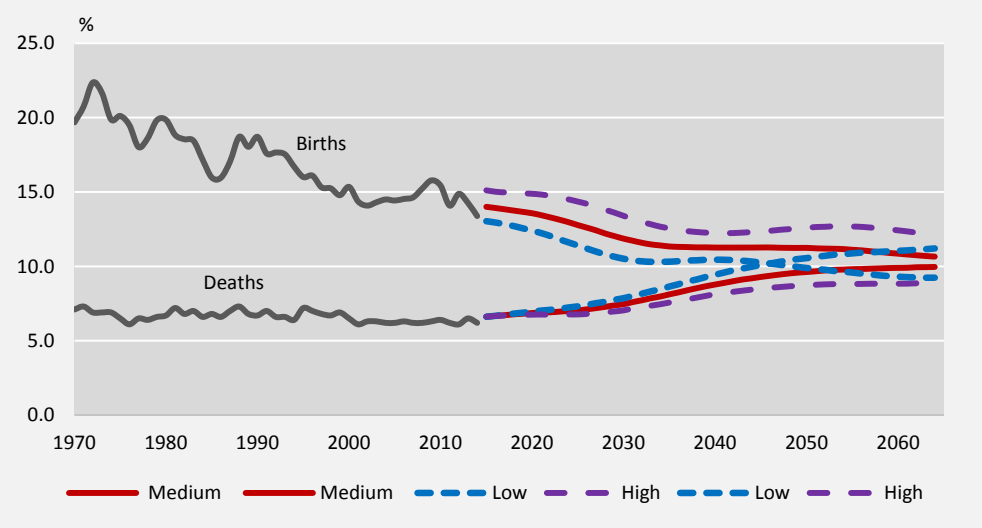
All variants display a decline for about 30 years, followed by a slight recovery. The latter phenomenon is explained by the local peak in the number of births recorded in 2008–2010 (figure 3) and by the average age of mothers which was 32 years during this period. The forecast of total fertility rate allows calculations of the number of future births and thus birth rates (births per 1,000 people per year) shown in figure 3.

The total fertility rate evolves from 1.87 (medium) in 2015 to 1.83 (medium), 1.98 (low) and 2.15 (high) in 2019 and to 1.94 (medium), 1.80 (low) and 2.10 (high) at the end of the projection period, 2065. In figure 3, the 80% confidence intervals of short term predictions (of +/- 0.17 width in 2018) are smoothly connected to the low and high values fixed by variant assumptions for 2065.

Increase of life expectancy

Figure 3 also contains the long term evolution of the crude death rates (number of deaths per year per 1,000 persons). They are used for calculating life expectancies. The increase in the death rate is due to population aging which is analysed in more detail in the following section. People in Iceland will live longer: the life expectancy at birth (the average number of living years left) will grow from 79.5 and 83.5 years in 2015 to 84.3 and 88.5 years in 2065, for men and women respectively.

Figure 3. Crude birth rate and death rate 1960–2065



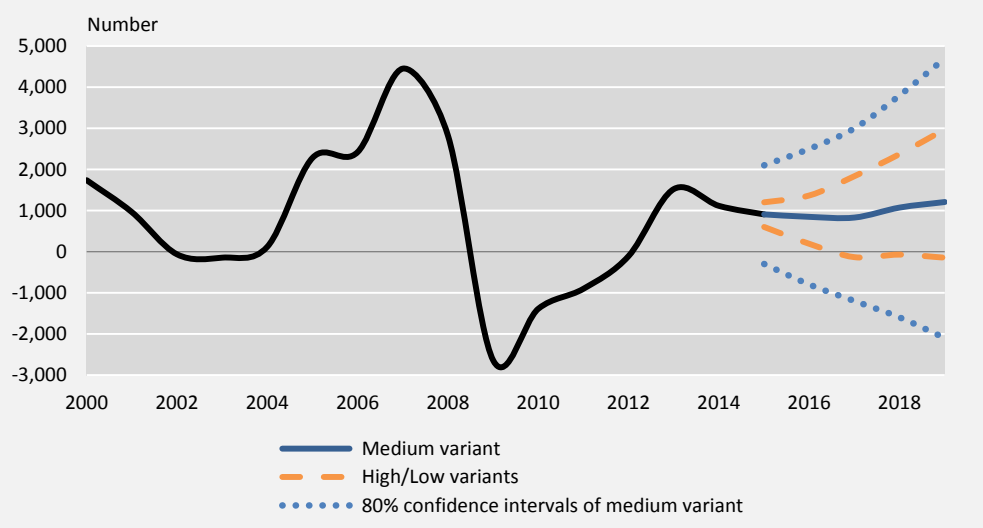
Migration and population growth

As a result, the *natural population increase* (the difference between the number of births and deaths per year) remains positive throughout the period, although it slows down, for both medium and high variants. This can be seen in figure 3, where the curves for birth and death rates do not intersect before 2065. The low variant of the population projection, based on the hypothesis of low net migration and low fertility rates, has a different result: the number of deaths per year exceeds the number of births per year, after 2045.

The change in total population is also influenced by migration processes to a significant extent. Modelling migration processes has become more challenging because of strong fluctuations in the Icelandic economy in recent years. For short term forecasting, dynamical time series models are used which take into account, due to their statistical significance, economic factors (GDP and unemployment) and educational parameters (number of graduating students).

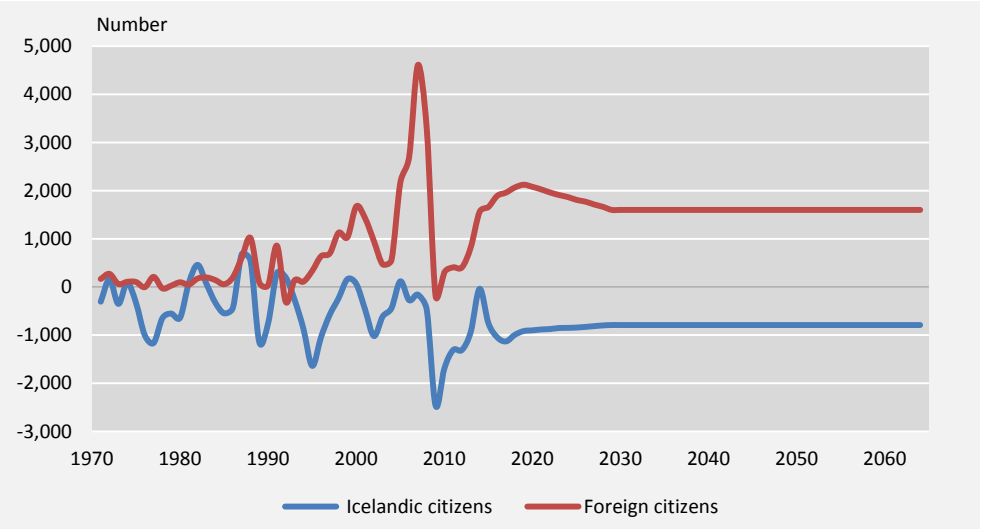
The *net migration rate* (difference between number of immigrants and emigrants per year) will stay positive in the next 5 years, for the medium variant, although its 80% confidence intervals do not exclude zero net migration for all but the first year. The high variant also stays positive but the low one reaches negative values by 2017, as shown in figure 4.

Figure 4. Net migration per year 2000–2018



This trend is similar for the long term predictions as well. The positive values are always due to positive net migration rates of foreign citizens. The net migration rates of Icelandic citizens will be negative although not very large in absolute values (see figure 5).

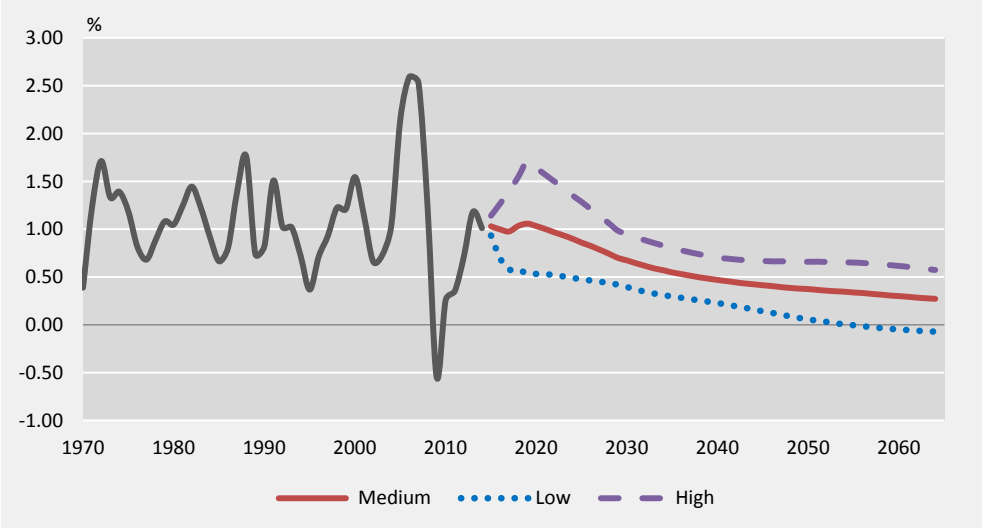
Figure 5. Net migration of Icelandic and foreign citizens 1970–2065, medium variant



The long term values are kept constant, mainly due to lack of long term economic prediction, i.e. the net migration rate is assumed to be equal to -800 and 1,600 persons (per year) of Icelandic and foreign citizenship, respectively.

The *total population increase* is an annual percentage rate which measures the total change between two successive years (see figure 6), due to both natural and migration processes.

Figure 6. Yearly population increase 1970–2065



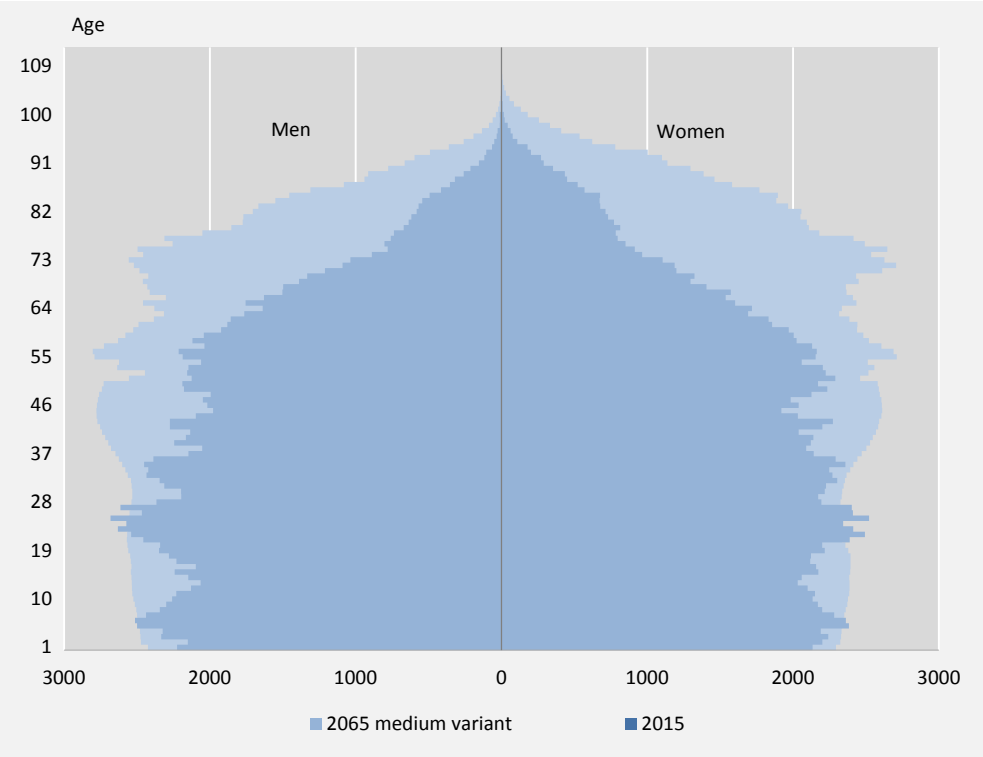
Comparing figures 3 and 6, it can be seen that the positive net migration rates postpone the time for the population decreas by about 10 years, in the low variant. It also enhances the positive values of the high and medium variants. During the past 50 years, the yearly value of the population increase has been oscillating around 1% and a similar behaviour is predicted for the next 50 years. The percentage is predicted to decrease after 2056 according to the low projection variant.

Changes in population structure

The age pyramids

The changes in population age and sex distribution are presented in a compact way by age pyramids. They visualise the number of men and women by age for each year. For 2065, the medium variant age pyramid is shown against the 2015 age pyramid in figure 7.

Figure 7. Age pyramids for 2015 and 2065 (medium variant)



The main consequence of the age structure development is that the following annual indicators all increase with time:

* the ratio between the number of men and women
* the old and young dependency ratios
* the number and percentage of people of old age.

Changes in sex ratio

The ratio between the number of men and women (men per 1,000 women per year) will evolve as follows.

Figure 8. Population sex ratio 1950–2065

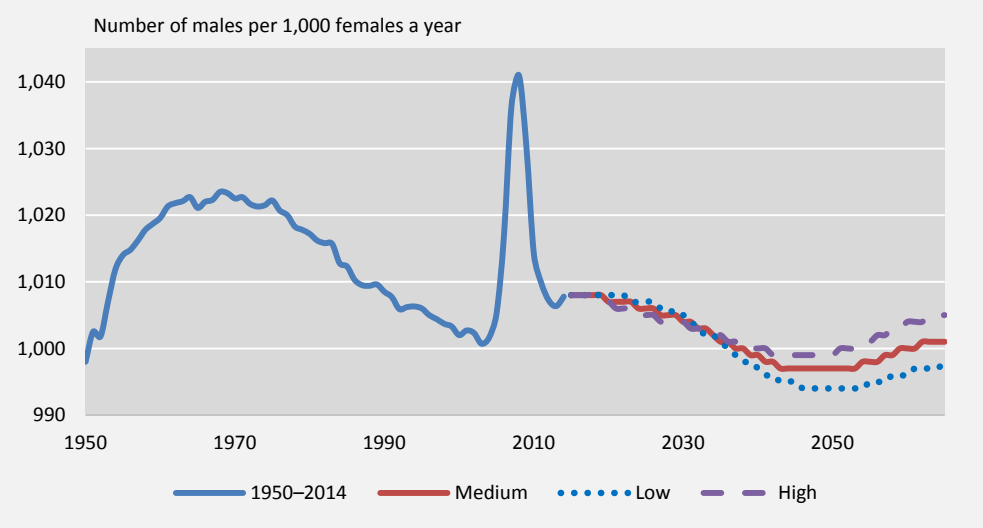


Figure 8 shows that the sex ratio will decrease, in the medium variant, until 2047, to its lowest value since 1950. After 2040, its value is even smaller than 1,000 (and stays like that until 2057). This means that the total number of men (all ages) is smaller than the total number of women for each year, after 2040.

In order to explain this we need to take into account that:

a) the sex ratio at birth is on average 1,053.3 boys to 1,000 girls
b) men have a shorter life expectancy than women, although this difference has decreased in recent years and will continue to do so
c) unless a strong perturbation occurs (usually due to migration, but sometime natural increase), the population sex ratio will decrease naturally over time.

Figure 8 illustrates this:

- the peak before 1960 is due to natural population increase, which had a local maximum between 1950–1960, and to the value of the sex ratio at birth
- the decline which can be seen after 1960 is a result of a higher number of deaths among men than women between 1960 and 1990 (which were mainly due to cardiovascular diseases)
- the peak just before 2010 is due to the high migration levels during the economic boom of 2002–2006, which basically postponed the natural decline of the sex ratio (which started in the 1970's and was already approaching the value of 1,000 in the year 2003) by almost 30 years
- the increase seen after 2050 is due to the increasing life expectancy of men with time.

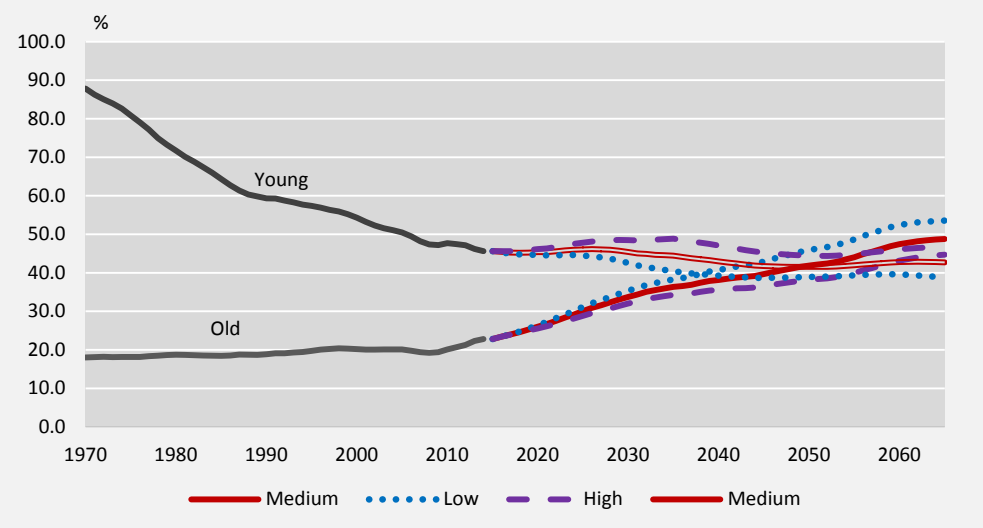
Most European countries, and countries with ageing populations in general, have fewer men than women.

Changes in dependency ratios

The age distribution of the population evolves in time as well. As a result, we will witness a continuous rise in the number of people who do not belong to the working ages (defined as 20 to 65). The ratio between these numbers and the number of working age people, for each year, define the so-called dependency ratios. The dependency ratios for the old and the young will interchange their traditional roles in the next decades, according to medium and low scenarios.

As shown in figure 9, the active population will have to support more people of older than younger ages, according to the medium variant already in 2050, and in 2037 according to the low variant. The support of the young is always dominant for the high projection variant. This can also be noticed by looking at the age pyramids (figure 7).

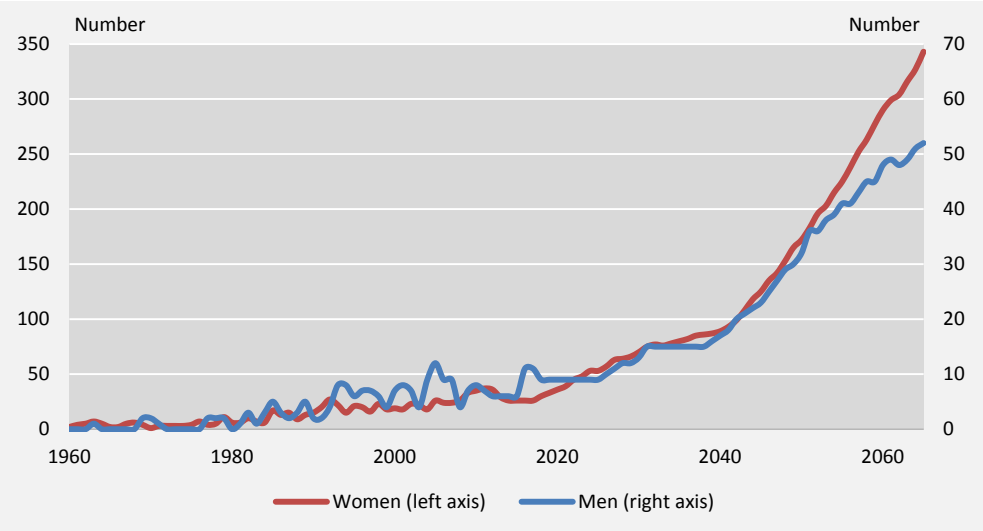
Figure 9. Old and young dependency ratios (percentage per year)



Many generations per family

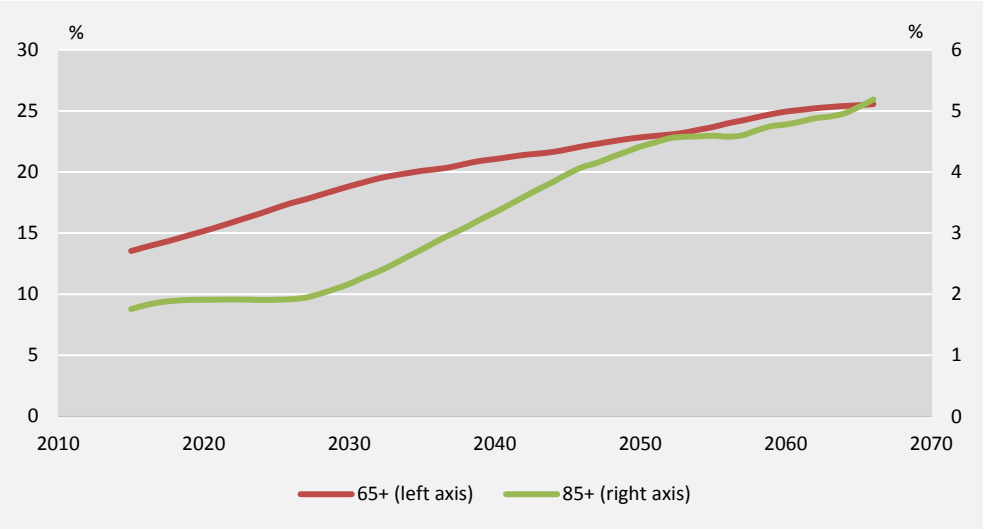
The difference in life expectancy between men and women will have an influence on the evolution of the annual number of older people in Iceland. For example, the number of centenarians (per year) will increase in the next five decades, especially among women. Figure 10 shows when some of the large number of people born after 1940 reach the age of 100 years, around 2040. The number of men surviving to this age is much smaller than the number of women.

Figure 10. The number of men and women over 100 years old, per year, 1960–2065



The annual number of people over 65 years old will also grow significantly, according to the predictions for all variants. By 2035, one in five Icelanders, and by 2061 already more than a quarter of the people, will be over 65 years old.

Figure 11. The proportion of people older than 65, per year, medium variant



The annual rate of growth of the proportion of people over 85 years of age is expected to increase with time, as shown in figure 11, doubling its value in approximately 20 years.

This is in agreement with the European statistical office, Eurostat, projections for EU states in the next 50 years.[1] As a result, *family patterns* in Iceland will become richer, linking more generations than we are used to in present times.

[1] http://epp.eurostat.ec.europa.eu

Conclusions

Iceland remains a young country

Although the population is ageing and the population growth is rather slow, Iceland is and will be younger than most European countries, where more than one third of all people will be over 65 years old in 2065, compared with only a quarter in Iceland.

An important factor in slowing down population ageing is the total fertility rate, which is still relatively high in Iceland and comparable only with the French and Irish rates in Europe. As a consequence, the number of births in Iceland will continue to exceed the number of deaths for the medium and high projection variants during 2015–2065 and for most of the time even in the low projection variant, in stark contrast to the EU figures.[1] For EU as a whole, a natural decrease (more deaths than births) is expected already in 2015 resulting in a population growth based entirely on positive net migration rates in some countries or a population decline in others.

Appendix 1. The projection variants

For the current projection, the alternative forecasts or *projection variants* are built as follows:

- The short term values for migration and fertility rates and the short and long term predicted values of mortality rates are based on time series modelling. The latter are used for life expectancy calculations.
- Short term migration rates are modelled for three different economic scenarios. The medium scenario is based on the current Statistics Iceland predictions for GDP growth and unemployment rates. The optimistic (or "high") scenario assumes higher GDP growth (double than the current Statistics Iceland predictions) and low unemployment. The pessimistic (or "low") scenario assumes no GDP growth and high unemployment.
- The long term values of net migration rates and fertility rates are constrained to converge to fixed values given by expert assumptions.
- No high and low variants are assumed for the mortality rates.
- The low total population projection variant is obtained from: low net migration predictions and low fertility rates predictions; the high population projection variant is obtained from: high net migration rates and high fertility rates predictions.

Appendix 2. Methods

The mathematical methods are described in detail in an accompanying working paper.[2] The methodology used for modelling and forecasting has been updated. The calculations have two main parts.

The first is based on time series analysis methods taking into account:

- previous data on migration, births and deaths
- economic and educational short term predictions

[1] http://epp.eurostat.ec.europa.eu

[2] http://www.hagstofa.is/utgafur/

- several conditions concerning the population components and their interaction
- the population at the beginning of the current year.

As a result of modelling the future distribution of migration, births and deaths by sex, age and citizenship can be predicted.

The second part consists of combining the results mentioned above, at each time step, such that: the number of persons in a given year who have a given age is the number of persons in the previous year who were one year younger, plus the number of corresponding age persons who moved to Iceland minus the number of same age people who died or emigrated during that year. This simple balance does of course add the number of children born in the previous year when calculating the total numbers for the corresponding age groups.

The reference date for each year is 1st of January and the data used are register data.

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