Statistisk sentralbyrå
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Norway's 2024 national population projections

Results, methods, and assumptions

TALL SOM FORTELLER

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Preface

This report presents results from the 2024 national population projections, along with a detailed account of the underlying assumptions. It also describes how Statistics Norway produces the Norwegian national population projections, using the BEFINN model. The national population projections are published biennially. More information about the population projections is available at https://www.ssb.no/en/folkfram.

Statistics Norway, 5 June 2024

Linda Nøstbakken

Abstract

The 2024 national population projections show a declining rate of population growth, strong population ageing, and a larger, more established, and older immigrant population. According to the main alternative, the Norwegian population will increase from around 5.55 million today to 6 million in 2040 and above 6.2 million in 2100. We expect more births than deaths up to 2045, after which the situation reverses, and population growth comes to be driven by immigration alone. The immigrant share of the population is projected to increase from just under 17 percent today, to around 22 percent by 2050. At the same time, the future immigrant population will be more established, with typically long durations of residence and strong growth in older ages. This aligns with a broader trend of population ageing in Norway. During the next decade, the population will be composed of more older persons (65+ years) than children and teenagers (0-19 years). As a group who tend to be major users of health and care services today, the population aged 80 or older is expected to more than double by 2050 and comprise almost one million individuals by 2100.

The results of population projections depend on the assumptions used for the underlying demographic components. We use different assumptions for future developments in fertility, life expectancy and immigration: Medium (M); high (H); low (L); constant (C); zero net migration (E); and no migration (0). We project the population in 15 combinations of these assumptions. Each projection alternative is described using three letters in the following order: Fertility, life expectancy, and immigration. The term ‘main alternative’ is used to refer to the MMM alternative, which indicates the use of the medium-level assumption for all three components.

The medium assumption for fertility (low and high in parentheses) is that the total fertility rate (TFR) will gradually increase from today’s historically low level (1.40 children per woman) to 1.44 in 2025 and 1.57 in 2030. In the longer run, TFR is assumed to stabilize at around 1.66 (low 1.21, high 1.91). Life expectancy is assumed to increase throughout the century. For men, the medium life expectancy assumption projects an increase from 81.4 years in 2023, to 86.0 (low 83.3, high 88.4) years in 2050 and 92.1 (low 87.3, high 96.3) years in 2100. For women, an increase from 84.6 years in 2023 to 88.3 (low 85.9, high 90.5) years in 2050 and 93.4 (low 89.0, high 97.3) years in 2100, is assumed. Immigration in the short term is expected to be lower than in 2022 and 2023, but still high from a historical perspective due to the anticipated arrival of Ukrainian refugees. In the medium assumption we assume that immigration to Norway will decline from 85 000 in 2023 to 76 000 in 2024 (low 53 000, high 94 000). Thereafter, the immigration assumptions settle on more stable long-run trajectories, with immigration assumed to be around 64 000 (low 45 000, high 88 000) in 2025, 49 000 (low 39 000, high 59 000) in 2030, 44 000 (low 30 000, high 66 000) in 2050, and 40 000 (low 15 000, high 88 000) in 2100. The projected emigrations depend partly on the immigrations. In the main alternative, we project a decline in net immigration from around 41 000 (low 19 000, high 59 000) in 2024, to around 16 000 (low 9 000, high 24 000) in 2030. From 2050 onwards, the main alternative expects annual net immigration to stabilise at around 13 000.

This report documents how the national population projections are produced, using Statistics Norway’s BEFINN model. The population is projected by age and sex to the year 2100. Immigrants from three country groups, Norwegian-born with two immigrant parents, and the rest of the population are projected as separate groups. The report begins by providing an overview of the main results, after which a more detailed presentation and discussion of the fertility, mortality, and international migration assumptions is given.

Population projections are inherently uncertain. Future immigration is subject to the most pronounced degree of uncertainty, but trends in fertility, mortality, and emigration can also end up rather different than expected. The ongoing war in Ukraine means that uncertainty, at least in the short term, is more pronounced than usual.

Sammendrag

I de kommende tiårene viser de nasjonale befolkningsframskrivingene for 2024 viser lavere befolkningsvekst, sterk aldring av befolkningen og en større, mer etablert og eldre innvandrer-befolkning. Ifølge hovedalternativet vil den norske befolkningen øke fra rundt 5,55 millioner i dag til 6 millioner i 2040 og til over 6,2 millioner i 2100. Vi forventer flere fødsler enn dødsfall frem til 2045, hvor situasjonen snur, og befolkningsveksten blir drevet av innvandring alene. Andelen innvandrere i befolkningen forventes å øke fra litt under 17 prosent i dag til omtrent 22 prosent innen 2050. Samtidig vil den fremtidige innvandrerbefolkningen være mer etablert, med mange som har lang botid. Vi vil også få sterk vekst i eldre aldersgrupper i innvandrerbefolkningen. Dette samsvarer med en bredere trend med aldring av befolkningen i Norge. I løpet av det neste tiåret vil befolkningen bestå av flere eldre personer (65+ år) enn barn og unge (0-19 år). Befolkningen over 80 år, en gruppe som i dag er store brukere av helse- og omsorgstjenester, forventes å mer enn doble seg innen 2050 og utgjøre nesten én million individer innen 2100.

Resultatene av befolkningsframskrivingene avhenger av antakelsene som brukes for de under-liggende demografiske komponentene. Vi bruker ulike antakelser for fremtidig utvikling innen fruktbarhet, forventet levealder og innvandring: Medium (M); høy (H); lav (L); konstant (C); null nettoinnvandring (E); og ingen innvandring (0). Vi framskriver befolkningen i 15 kombinasjoner av disse antakelsene. Hvert prognosealternativ beskrives ved hjelp av tre bokstaver i følgende rekke-følge: Fruktbarhet, forventet levealder og innvandring. Begrepet 'hovedalternativ' brukes for å referere til MMM-alternativet, som indikerer bruk av middelsnivåantakelsen for alle tre komponent-ene.

Ifølge de nasjonale befolkningsframskrivingene er det forventet at fruktbarheten gradvis vil øke fra dagens historisk lave nivå (1,40 barn per kvinne) til 1,44 i 2025 og 1,57 i 2030. På lengre sikt antas det at fruktbarheten vil stabilisere seg rundt 1,66 (lav 1,21, høy 1,91). Forventet levealder forventes å øke gjennom hele århundret. For menn antas den gjennomsnittlige forventede levealderen å øke fra 81,4 år i 2023 til 86,0 (lav 83,3, høy 88,4) år i 2050 og 92,1 (lav 87,3, høy 96,3) år i 2100. For kvinner forventes en økning fra 84,6 år i 2023 til 88,3 (lav 85,9, høy 90,5) år i 2050 og 93,4 (lav 89,0, høy 97,3) år i 2100. Innvandringen på kort sikt forventes å være lavere enn i 2022 og 2023, men likevel høy fra et historisk perspektiv, på grunn av den forventede ankomsten av ukrainske flyktninger. I det midtre alternativet antar vi at innvandringen til Norge vil avta fra 85 000 i 2023 til 76 000 i 2024 (lav 53 000, høy 94 000). Deretter stabiliserer innvandringsantakelsene seg på mer stabile langvarige baner, med antatt innvandring rundt 64 000 (lav 45 000, høy 88 000) i 2025, 49 000 (lav 39 000, høy 59 000) i 2030, 44 000 (lav 30 000, høy 66 000) i 2050 og 40 000 (lav 15 000, høy 88 000) i 2100. De fram-skrevne utvandringene avhenger delvis av innvandringen. I hovedalternativet forventer vi en nedgang i nettoinnvandring fra omtrent 41 000 (lav 19 000, høy 59 000) i 2024 til omtrent 16 000 (lav 9 000, høy 24 000) i 2030. Fra 2050 forventer hovedalternativet årlig nettoinnvandring på rundt 13 000.

Denne rapporten dokumenterer hvordan de nasjonale befolkningsframskrivingene produseres ved hjelp av Statistisk sentralbyrås BEFINN-modell. Befolkningen framskrives etter alder og kjønn frem til år 2100. Innvandrere fra tre landgrupper, norskfødte med to innvandrerforeldre og resten av befolkningen, framskrives som separate grupper. Rapporten gir først en oversikt over hoved-resultatene, etterfulgt av en mer detaljert presentasjon og diskusjon av fruktbarhets-, dødelighets- og migrasjonsantakelsene.

Befolkningsframskrivinger er i seg selv usikre. Fremtidig innvandring er gjenstand for den sterkeste graden av usikkerhet, men trender innen fruktbarhet, dødelighet og utvandring kan også ende opp ganske annerledes enn forventet. Den pågående krigen i Ukraina betyr at usikkerheten, i det minste på kort sikt, er mer uttalt enn vanlig.

Contents

1. Main results – national population projections

A declining rate of population growth, strong population ageing, and a larger, more established, and older immigrant population. These are the main results of the 2024 national population projections.

Statistics Norway's 2024 main alternative projects an increase in the Norwegian population from around 5.55 million today, to 6 million in 2040 (Figure 1.1) and above 6.2 million in 2100. We expect more births than deaths up to 2045, after which the situation reverses, and population growth comes to be driven by immigration alone. The immigrant share of the population is projected to increase from 16.8 percent today, to around 22 percent by 2050. Thereafter, the share declines somewhat, to around 20 percent by the end of the century. At the same time, the future immigrant population will be more established, as immigrants age in place and their durations of residence increase. This aligns with a broader trend of strong population ageing in Norway. During the next decade, the population will be composed of more older persons (65+ years) than children and teenagers (0-19 years) (Figure 1.2). As a group who tend to be major users of health and care services today, the population aged 80 or older is expected to more than double by 2050 and is projected to comprise almost one million individuals by 2100.

Box 1.1 What do the H-M-L abbreviations mean?

The national population projections are produced using Statistics Norway's BEFINN model (described in Chapter 3). The population is projected by age and sex to the year 2100. Immigrants from three country groups, Norwegian-born children with two immigrant parents, and the rest of the population are projected as separate groups.

We use the cohort-component method, with two types of input: i) Updated figures for the national population by sex and one-year age groups; and ii) assumptions about future developments in the demographic components (fertility, life expectancy, and international migration).

The results of a population projection are largely dependent on the assumptions used for the different components. With projections inherently uncertain, it can be useful to formulate different alternatives for the future development of the population. As such, several alternative projections are developed, with different combinations of assumptions. Each projection is described using three letters (H=high, M=medium, L=low) in the following order: 1) Fertility; 2) Life expectancy; and 3) Immigration.

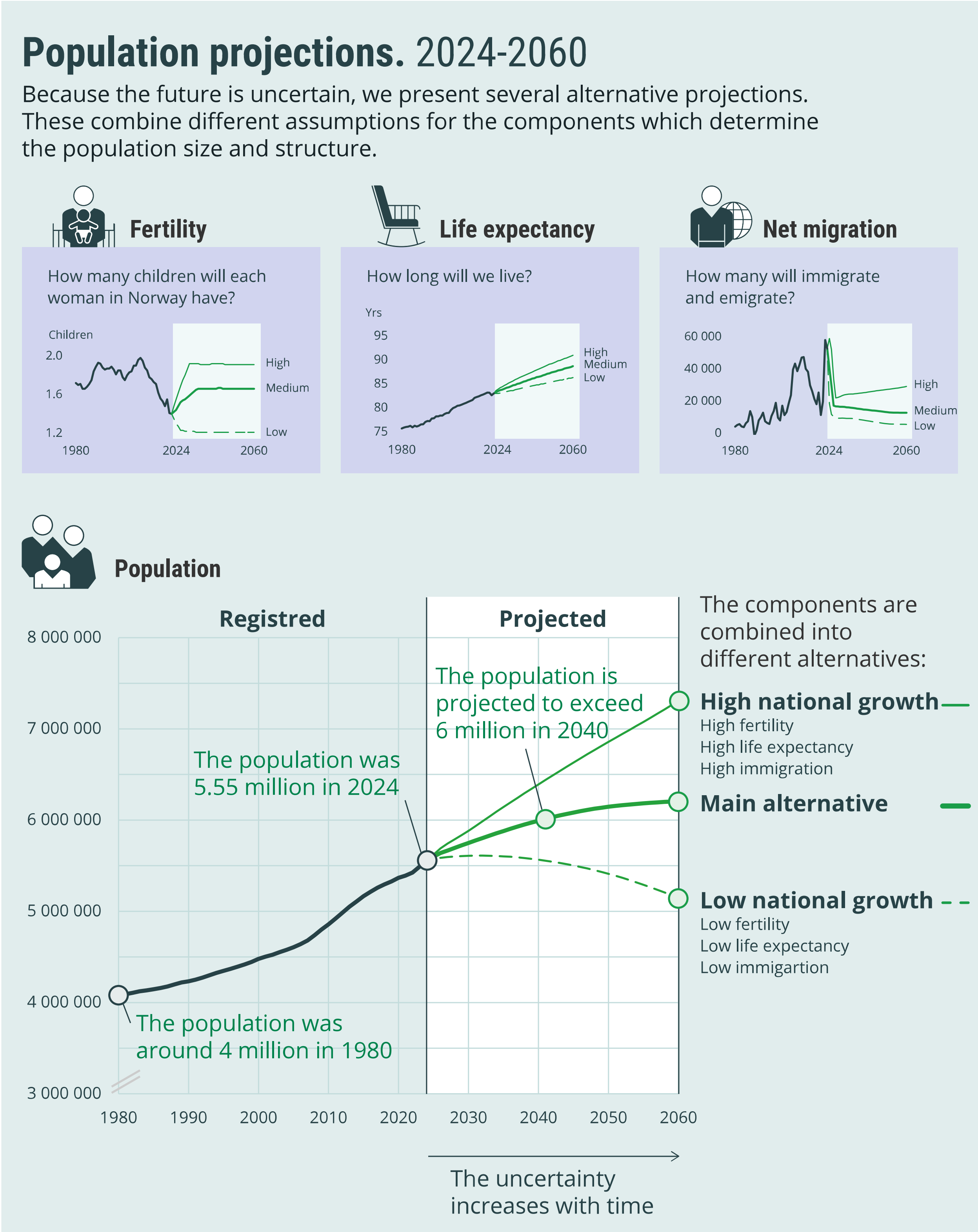
The main alternative, MMM, uses the medium level for each of the three components. These medium level assumptions are those that we consider to be the most plausible. The assumptions can be combined in a variety of ways. As an example, the LHL alternative describes a population trend with low fertility, high life expectancy, and low immigration, i.e., strong ageing.

For fertility, life expectancy and immigration, we create high, medium, and low alternatives, whereas for emigration we primarily use a medium alternative. We also draw up alternatives with constant immigration (MMC) and constant life expectancy (MCM), as well as alternatives without international migration (MM0) and with zero net migration (MME), i.e., equal immigration and emigration. The latter four alternatives are primarily used for analytical purposes.

It is unlikely that fertility, life expectancy and immigration will all remain high (or low) throughout the projection period. Nevertheless, the span between the HHH and LLL alternatives illustrates a potential degree of uncertainty surrounding the projected total population figures and demonstrates the degree to which the results depend on the different assumptions used. Sources of uncertainty associated with population projections are discussed in greater detail in Chapter 8.

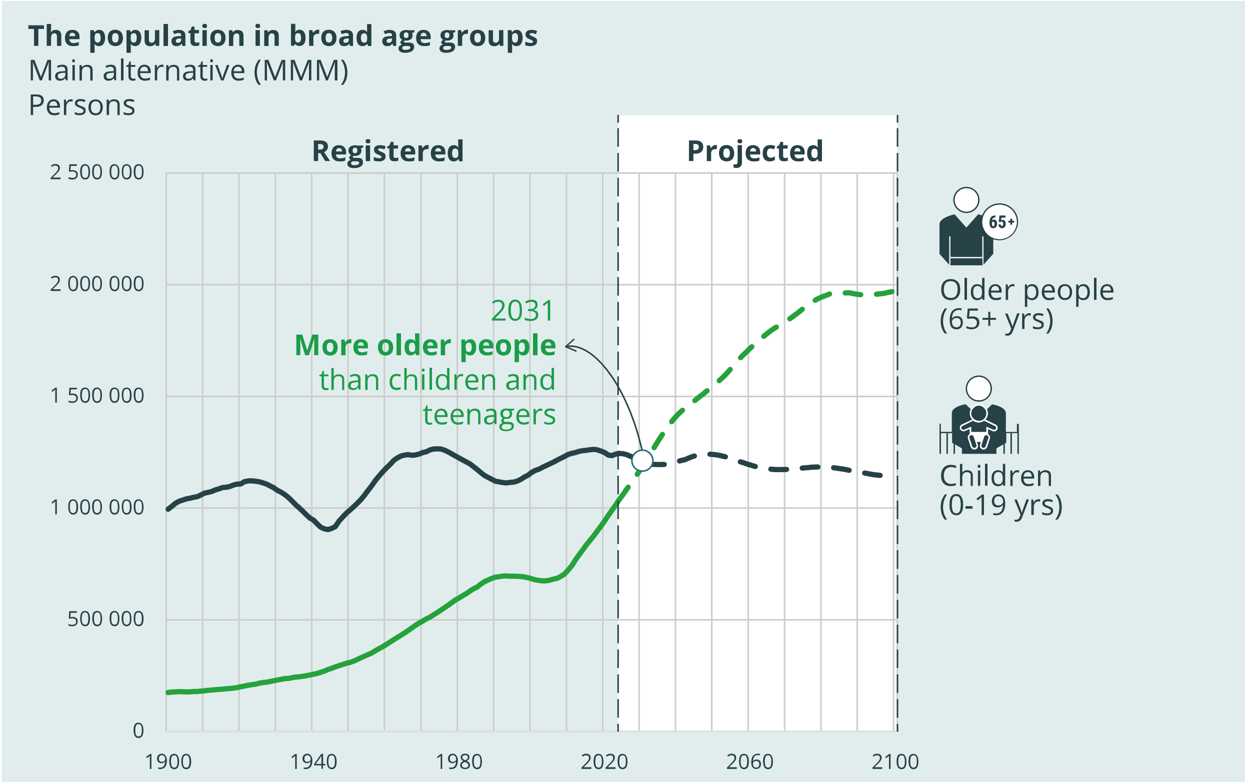
Underlining the uncertainty in the projections, different projection alternatives are provided. Population growth varies considerably according to these different alternatives. For instance, by 2050, the population ranges from 5.4 million in the low national growth alternative to almost 6.9 million in the high national growth alternative (Figure 1.1). With that said, all alternatives indicate a pronounced ageing of the population in the years to come.

Figure 1.1 An overview of the assumptions and the resulting population figures for Norway, registered and projected in three alternatives



Source: Statistics Norway

Figure 1.2 A comparison of the number of older persons versus children and teenagers, registered 1900-2024 and projected 2025-2100



Source: Statistics Norway

As shown in Table 1.1, our medium assumption for fertility (low and high in parentheses) is that the total fertility rate (TFR) will gradually increase from today's historically low level (1.40 children per woman) to 1.44 in 2025 and 1.57 in 2030. In the longer run, TFR is assumed to stabilize at around 1.66 (low 1.21, high 1.91). Life expectancy is assumed to increase throughout the century, albeit to a lesser extent than in the previous projection round. For men, the medium life expectancy assumption projects an increase from 81.4 years in 2023, to 86.0 (low 83.3, high 88.4) years in 2050 and 92.1 (low 87.3, high 96.3) years in 2100. For women, an increase from 84.6 years in 2023 to 88.3 (low 85.9, high 90.5) years in 2050, and 93.4 (low 89.0, high 97.3) years in 2100, is assumed. Immigration in the short term is expected to be lower than in 2022 and 2023, but still high from a historical perspective due to the anticipated arrival of refugees fleeing the war in Ukraine. In the medium assumption we assume that immigration to Norway will decline from 85 000 in 2023 to 76 000 in 2024 (low 53 000, high 94 000). Thereafter, the immigration assumptions settle on more stable long-run trajectories. We assume a gross immigration to Norway of around 64 000 (low 45 000, high 88 000) in 2025, 49 000 (low 39 000, high 59 000) in 2030, 44 000 (low 30 000, high 66 000) in 2050, and 40 000 (low 15 000, high 88 000) in 2100. The projected emigrations depend partly on the immigrations. In the main alternative, we project a decline in net immigration from around 41 000 (low 19 000, high 59 000) in 2024, to around 16 000 (low 9 000, high 24 000) in 2030. From 2050 onwards, we assume net immigration will stabilise at around 13 000 per year in the main alternative.

Table 1.1 Population projections 2024, key figures of the assumptions[1]

	Registered 2023	Medium (M) assumption	High (H) assumption	Low (L) assumption
Total fertility rate, children per woman	1.40			
2025		1.44	1.55	1.30
2030		1.57	1.86	1.22
2050		1.66	1.91	1.21
2100		1.66	1.91	1.22
Life expectancy at birth, men	81.4			
2025		81.9	82.5	81.3
2030		82.8	83.9	81.6
2050		86.0	88.4	83.3
2100		92.1	96.3	87.3
Life expectancy at birth, women	84.6			
2025		84.9	85.4	84.4
2030		85.6	86.7	84.6
2050		88.3	90.5	85.9
2100		93.4	97.3	89.0
Yearly immigrations	86 589			
2025		63 800	87 900	45 200
2030		49 200	59 100	39 100
2050		44 200	66 400	30 000
2100		39 500	87 900	15 200
Yearly emigrations[2]	34 011			
2025		34 800	35 800	33 500
2030		32 700	35 300	30 100
2050		30 900	38 200	25 300
2100		26 300	49 600	13 900

[1] The figures for registered life expectancy are calculated slightly differently in the population projections than in the official statistics on life expectancy (see Box 6.1). The figures on yearly immigrations and emigrations do not include persons who have moved to and from Norway (or vice versa) during the same calendar year and are thus not fully comparable with those presented in the population statistics on migration.
[2] The M, H, and L figures for projected emigrations are obtained from the MMM, MMH and MML alternatives, respectively.
Source: Statistics Norway

In this chapter, we present the main results from the 2024 national population projections. These results stem from the assumptions made regarding future fertility, mortality, immigration, and emigration, outlined above, and presented in more detail in the later chapters of this report.

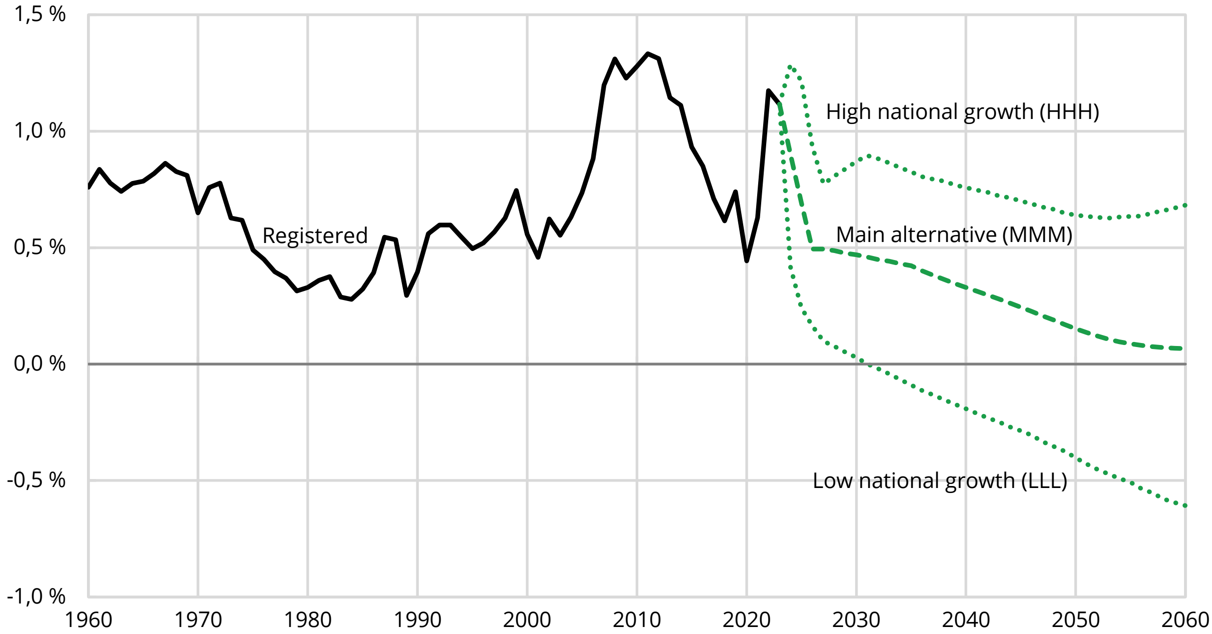
1.1. A declining rate of population growth

Both national and international demographic trends point to a declining rate of population growth in the future. United Nations (2022) data reveal that the rate of global population growth peaked in the 1960s, while 'peak child' (the highest total number of children aged under five) was reached in 2017. Although the global population will continue to grow for many decades, it too is expected to peak before the end of the century and be accompanied by strong population ageing (United Nations 2022). Statistics Norway's 2024 main alternative (MMM) projects a similar trend of declining rates of population growth.

Past, present, and future growth

During the period 2006–2016, the population grew by more than 0.8 percent annually, and in the peak years of 2011-2012, population growth was above 1.3 percent (Figure 1.3). The pronounced growth during this period had multiple causes. Immigration to Norway was unusually high following the eastward expansion of the European Union, while emigration saw only a moderate increase. The period up to 2010 also saw an increase in period fertility, with TFR peaking at 1.98 in 2009. Combined with a large share of the female population being of an age when it is common to have children, this resulted in many births. As immigrant women have relatively high fertility rates in the initial period after arrival, the upward trend in immigration also contributed to the high birth numbers. At the same time, the number of deaths was relatively low. This was primarily a consequence of the small interwar birth cohorts comprising the oldest age groups, but also due to a general increase in life expectancy. The growth rate declined thereafter and reached a low of 0.4 percent in 2020, when considerable restrictions to daily life and travel took hold during the COVID-19 pandemic. The growth rate reached another short-term peak in 2022 and 2023, primarily because of the large number of arrivals of displaced persons from Ukraine.

Figure 1.3 Annual rate of population growth in Norway, registered 1960-2023 and projected 2024-2060 in three alternatives



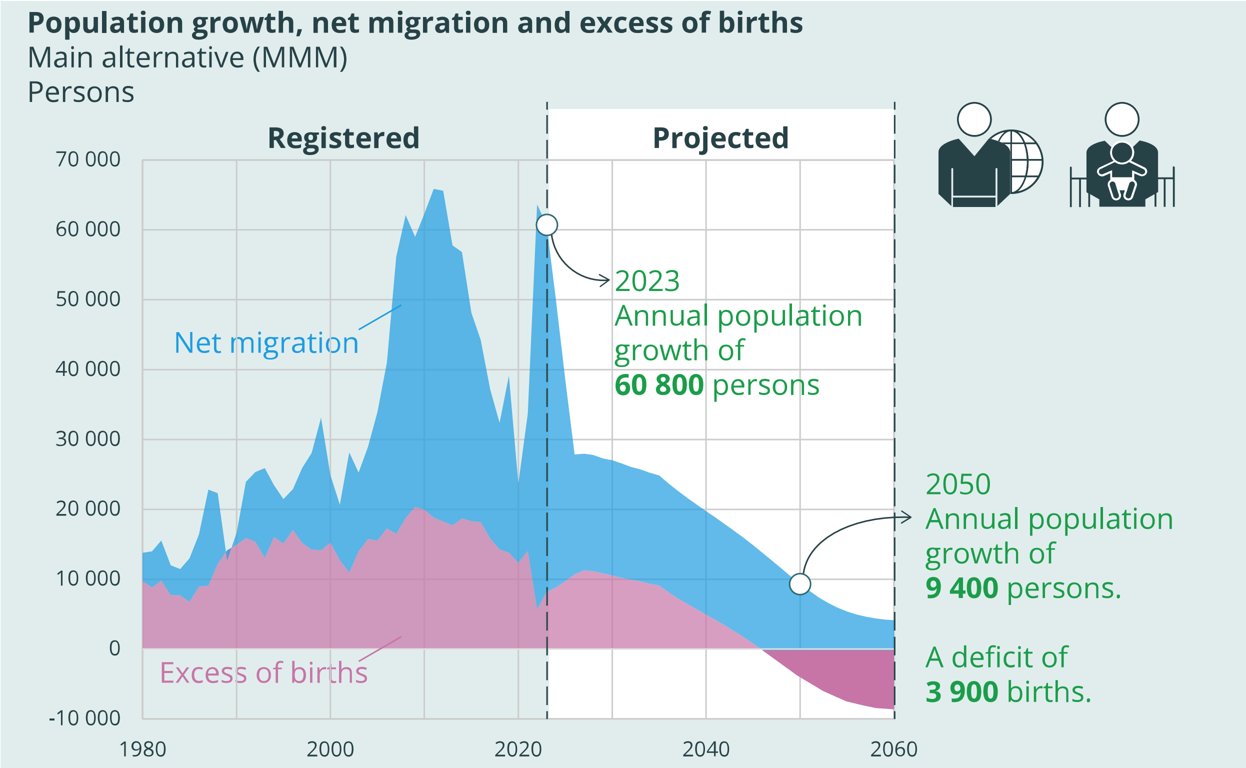
Source: Statistics Norway

In the short term, the main alternative projects a decline from the recent peak in population growth, though growth rates in 2024 and 2025 remain relatively high from a historical perspective due to the continued arrival of displaced persons from Ukraine. Our *ad hoc* adjustments for short-term Ukrainian immigration are described in more detail in Chapter 7. From 2026 onwards, the rate of growth more steadily declines. Underpinning this decline are a number of demographic trends, some of which we are confident of and others that are far more uncertain.

Regardless of the projection alternative used, the ageing of the population is inevitable because it is already written into the age structure of today's population. Although we expect a continued fall in the mortality rate (see Chapter 6), the number of deaths will steadily rise in the coming decades as the large cohorts born after World War II reach ages where it is more common to die. Future expectations for immigration and fertility are far more uncertain. While fertility is assumed to steadily increase from the record low TFR of 1.40 in 2023, we do not expect long-run fertility to return to the levels seen in the 1990s and 2000s (see Chapter 5). At the same time, the number of women in childbearing ages will not increase as much as it has in the past and is in fact projected to peak within a decade. Part of this peaking is linked to an assumed lower level of gross immigration to Norway. The long-run decline in immigration is based on assumptions for the future economic developments, in Norway and the sending countries, as well as global demographic developments (see Chapter 7). According to the main alternative, the annual growth rate will be below 0.2 percent in 2050, while population growth turns negative after 2080. In the low national growth (LLL) alternative, the population begins to decline already in the early 2030s, while even in the high national growth (HHH) alternative, the population grows at a rate typically well below that observed between 2006–2016.

Population growth can result from an excess of births, i.e., the number of births exceeds that of deaths, or from a positive net migration, where more people immigrate than emigrate, or indeed from both. Figures 1.4 and 1.5 show the relative contribution of excess births and net migration over time in Norway. Traditionally, the excess of births has been the largest contributor to population growth. Indeed, if we go back to the 1950s, net migration was consistently negative. However, for much of the last two decades, net migration has contributed most to the growth of the Norwegian population. According to the main alternative (MMM), net migration will continue to be a greater contributory factor than the excess of births, especially in the long term.

Figure 1.4 Population growth, net migration, and excess of births, registered 1980-2023 and projected 2024-2060[1]

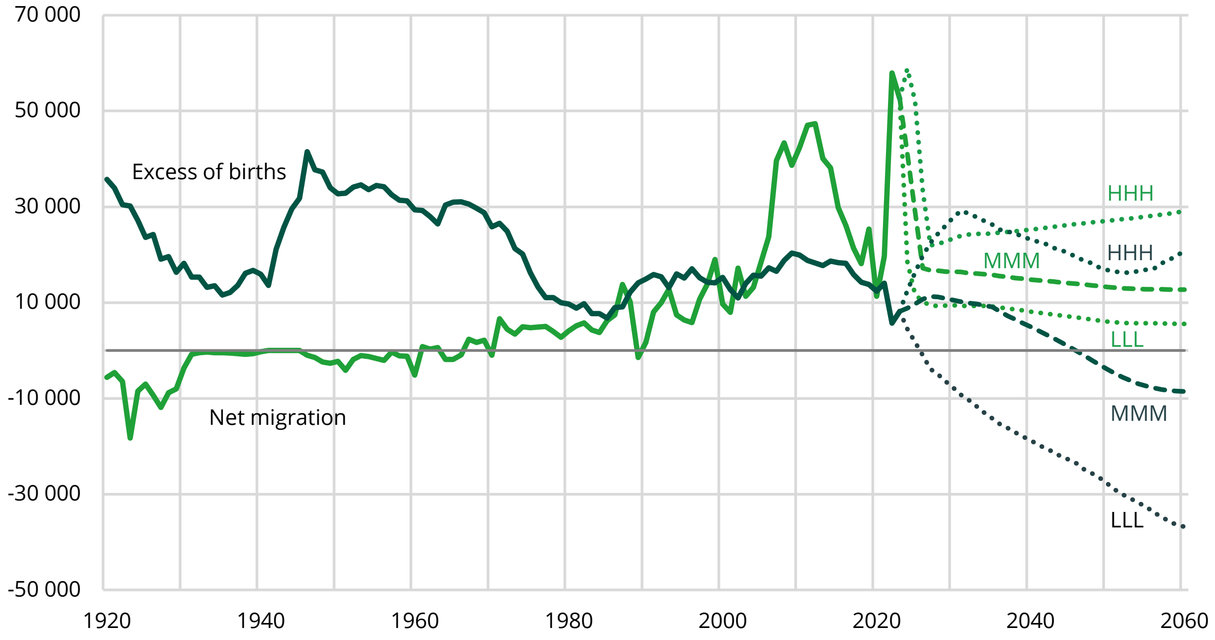


[1] Excess of births is number of births minus number of deaths. Net migration is immigrations minus emigrations.
Source: Statistics Norway

While Figure 1.4 shows only the main alternative, Figure 1.5 includes the variation in the low and high national growth alternatives. According to the high growth alternative, net migration becomes the main contributor to population growth from the late 2030s onwards. In the low growth alternative, net migration will continue to contribute to growth, while low fertility and low life expectancy will result in far more deaths than births, leading to a pronounced deficit of births within the next 10 years.

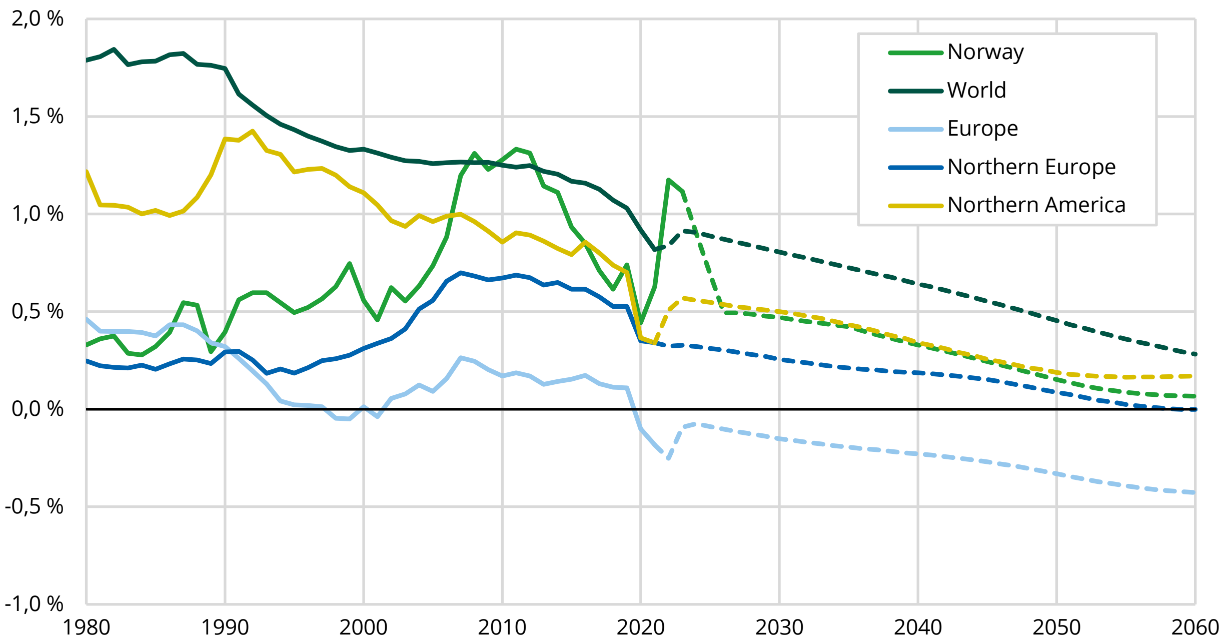
Although future population growth in Norway is expected to be lower than has been observed over the last 10-15 years, it will nevertheless be high compared with many other countries, not least in Europe. Figure 1.6 shows the percentage growth in Norway compared to what has been registered and projected by the United Nations (2022) for world regions. Several countries in Europe, primarily in southern and eastern parts, already have negative population growth. Europe as a whole has also entered into population decline and the United Nations expects this decline to strengthen into the future. While Northern Europe will keep growing over the next couple of decades, it too is expected to enter negative growth after 2060. The main alternative population growth rate for Norway broadly tracks between that of Northern Europe and Northern America.

Figure 1.5 Excess of births and net migration, registered 1900-2023 and projected 2024-2060 in three alternatives[1]



[1] Excess of births is number of births minus number of deaths. Net migration is immigrations minus emigrations.
Source: Statistics Norway

Figure 1.6 Population growth as a percentage, registered 1980-2021 and projected 2022-2060 for selected world regions, registered 1980-2023 and projected 2024-2060 for Norway[1]



[1] Northern Europe and Northern America follow the United Nations definitions. United Nations (2022) medium variant and Statistics Norway main alternative (MMM).
Source: United Nations and Statistics Norway

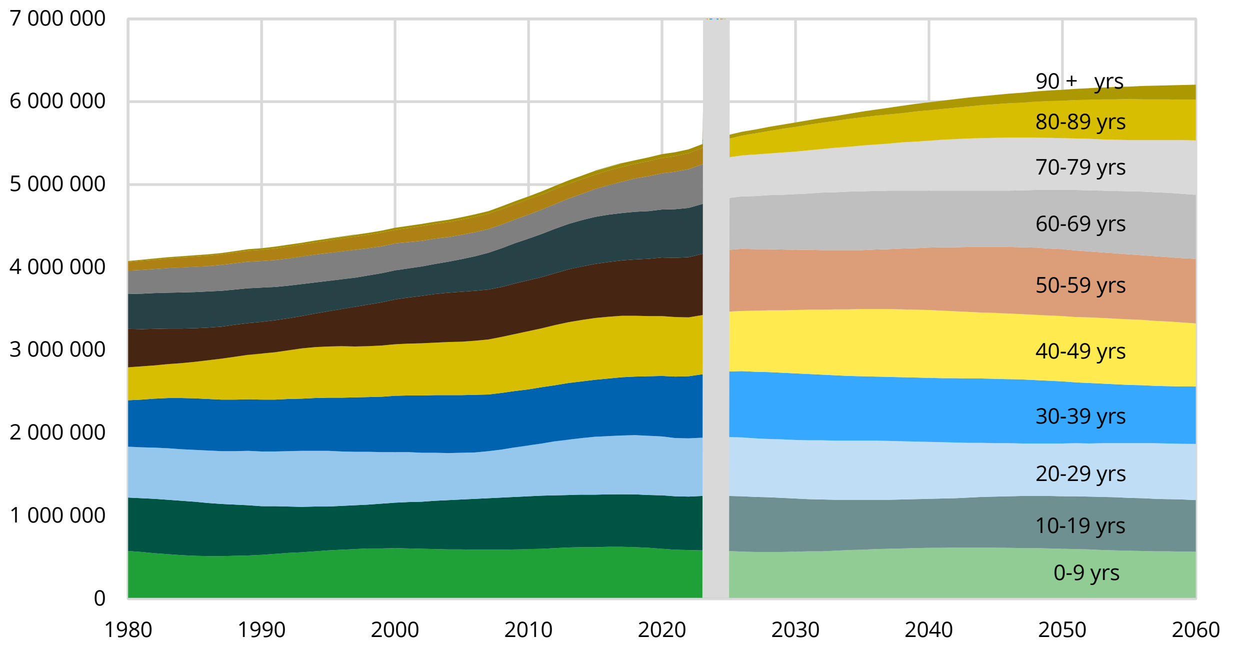
1.2. Strong ageing

The ageing of a population is determined by the number of births, the number of immigrants and emigrants and (remaining) life expectancy, as well as the current age structure of the population. The more newborns, the more (young) immigrants, the fewer (young) emigrants and the lower the life expectancy, the younger the population will be. Similarly, fewer new-borns, fewer immigrants, many emigrants, and a higher life expectancy will result in an older population. Over the last decade we have witnessed historically low numbers of births, historically high life expectancies and immigration that had typically trended downwards until the recent peak associated with the arrival of Ukrainian refugees. Overall, this resulted in a more pronounced ageing of the population than we have seen in prior periods. The process of population ageing is projected to continue in the years to come.

A more than doubling of the older age population

Both the number and share of older people will increase significantly in the future. The population aged 80 or older will more than double by 2050 and is projected to comprise almost one million individuals by 2100. Their share of the total population will also increase, from 4.6 percent today to almost 10 percent in 2050 and more than 15 percent by 2100, according to the main alternative. Meanwhile, the number of persons aged 90 or over is projected to almost triple by 2050.

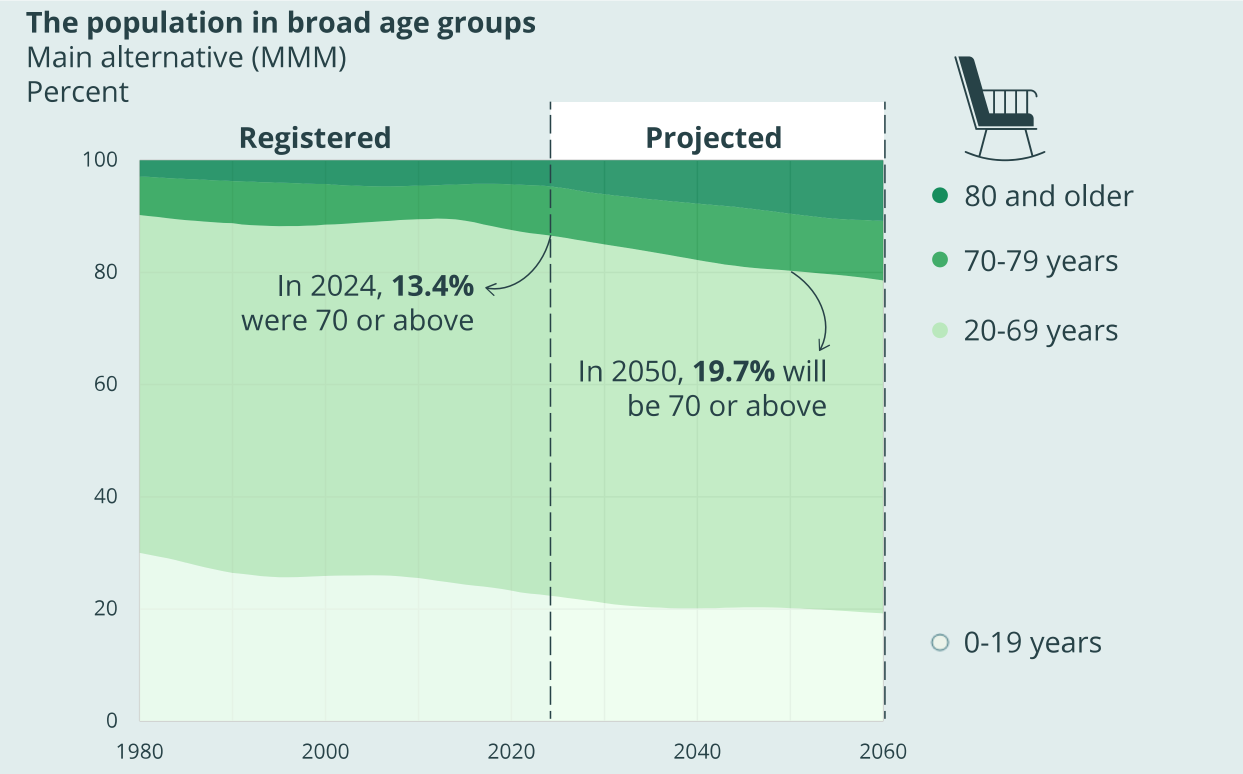
Figure 1.7 The population by age, registered 1980-2024 and projected 2025-2060, main alternative (MMM)



Source: Statistics Norway

Figure 1.7 presents the population divided into 10-year age groups and shows that the oldest age groups are expected to grow the most. While the number of people below age 70 will remain relatively stable in the coming decades, there is a persistent increase in the number of over 70s. Moreover, the relative increase in the older age groups gets stronger as we move up the age distribution. What is also noticeable from Figure 1.7 is that the share of the population in the typical working age groups gradually declines (see the sub-section on the 'dependency ratio' below). With that said, in absolute terms, we project this group to see some growth over the coming decade. The main alternative suggests that the population aged 20-64 will increase from 3.27 million in 2024, to a high of almost 3.4 million around 2035, before it gradually declines to below 3.2 million from 2075 onwards. Figure 1.8 shows the growth in the older age groups as a share of the population. Today, every eighth person (13 percent) in Norway is aged 70 or over. By 2050, the main alternative projects it to be one in five (20 percent), and by 2100 more than one in four (26 percent).

Figure 1.8 **Percentage share of the population in four broad age groups, registered 1980-2024 and projected 2025-2060**



Source: Statistics Norway

Table 1.2 **Older persons in different age groups in numbers (N) and percentages (%), registered and projected for selected years in three alternatives[1]**

	Total population	70+ years		80+ years		90+ years	
	N	N	%	N	%	N	%
2024	5 550 203	743 075	13.4	256 485	4.6	45 734	0.8
Main							
2030	5 749 700	862 900	15.0	349 000	6.1	51 400	0.9
2050	6 146 300	1 209 900	19.7	585 900	9.5	131 400	2.1
2100	6 243 300	1 617 800	25.9	962 200	15.4	349 100	5.6
Strong ageing							
2030	5 641 900	875 100	15.5	358 000	6.3	54 600	1.0
2050	5 638 200	1 295 700	23.0	659 800	11.7	170 200	3.0
2100	4 212 200	1 677 100	39.8	1 125 000	26.7	514 800	12.2
Weak ageing							
2030	5 849 700	850 300	14.5	339 900	5.8	48 300	0.8
2050	6 625 600	1 123 300	17.0	514 300	7.8	98 800	1.5
2100	8 908 100	1 591 000	17.9	816 100	9.2	215 400	2.4

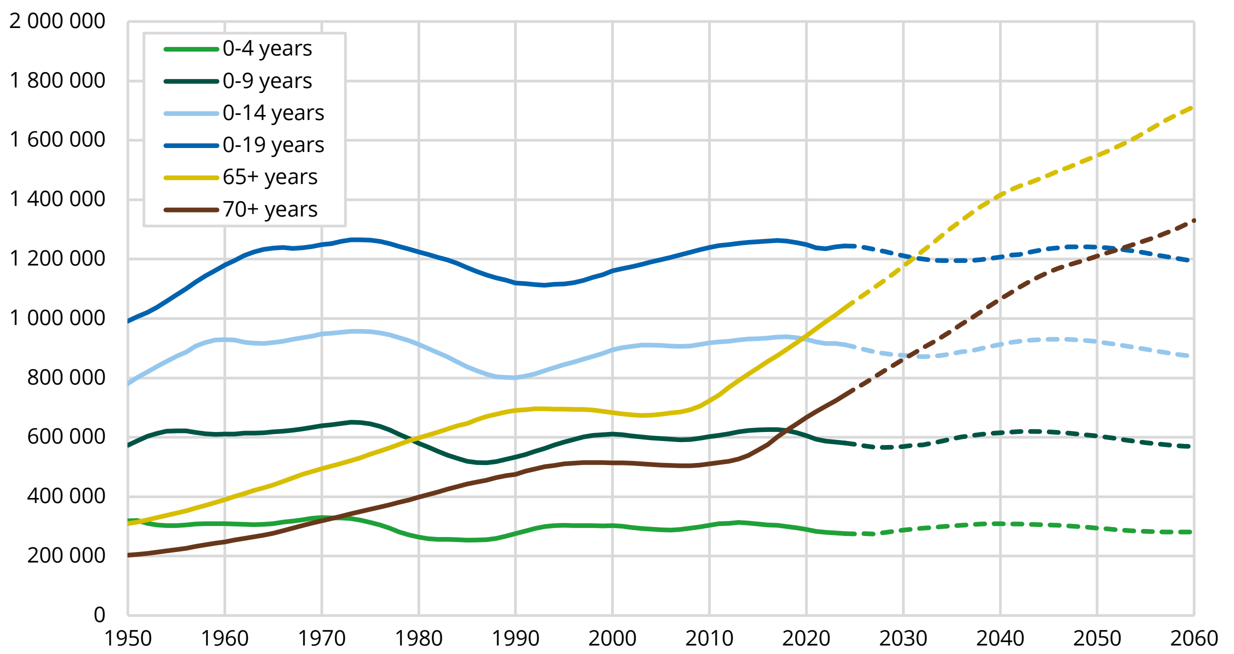
[1] The population estimates refer to the population on 1 January.
Source: Statistics Norway

Population projections provide several alternatives, with different assumptions about fertility, mortality, and immigration. These assumptions can be combined so that we get an alternative with strong ageing – where fertility is low, life expectancy high and immigration low – and an alternative with weak ageing – where fertility is high, life expectancy low and immigration high. These alternatives can help to illustrate how confident we are of future ageing. Even in the case of weak ageing, we still expect growth in absolute and relative terms among the older age groups (Table 1.2).

More older people than children and teenagers

Norway has always had more children and teenagers than older persons (aged 65+). This will cease to be the case soon. As shown in Figure 1.9 (and Figure 1.2), the number of young people is expected to remain fairly stable, while the number of older people will grow considerably. Within the next 10 years, our main alternative suggests that there will be more persons aged 65 or older than children and teenagers (0-19 years), with the difference getting larger as we move forward in time. The main alternative suggests that those aged 70+ will outnumber children and teenagers soon after 2050. By 2060, the population aged 65+ will outnumber the population of children and teenagers by more than half a million.

Figure 1.9 The number of children and teenagers in four age groups versus the number of older persons in two age groups, registered 1950-2024 and projected 2025-2060, main alternative (MMM)



Source: Statistics Norway

Dependency ratios

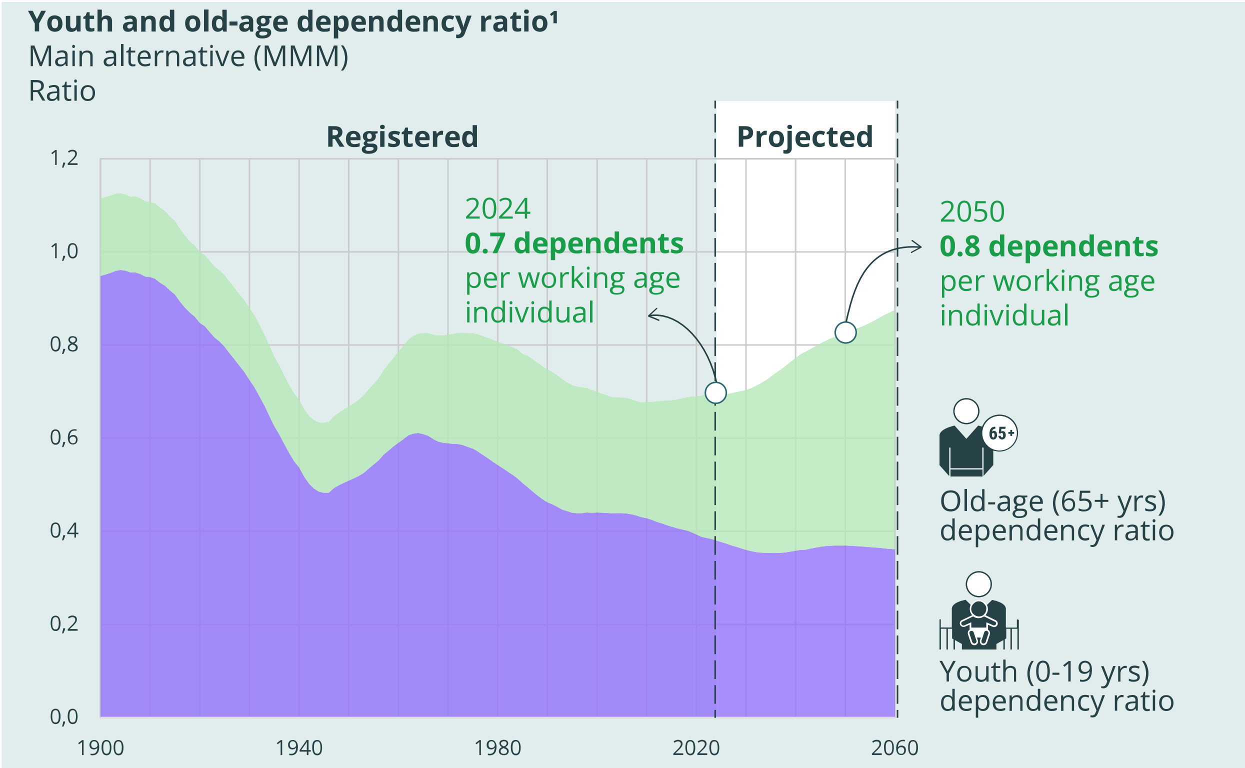
The ageing of the population will strongly influence the old-age dependency ratio (OADR). This measure shows the ratio of the number of older persons to the number of persons in working ages. As such, it provides a rough approximation of the 'burden' associated with the older-age population, to the 'productive' population, though it does not account for the actual employment rates of these groups, nor the share of older people who are truly dependent. Nevertheless, it is a simple and widely used measure that can illustrate aspects of the population structure that are of major importance to the labour market and government funding on the one hand, and pension costs, nursing and care needs and the like on the other.

In this report, we have chosen to calculate the OADR as the ratio between the number of persons aged 65 and over and the number of persons aged 20–64. The age of 65 is chosen as a cut-off point because it is close to the average age at first withdrawal of old-age pension in Norway (65.6 years for both sexes combined in 2023), according to the Norwegian Labour and Welfare Administration (NAV 2024).[1] The average first withdrawal age was 66.2 years for women and 65.1 years for men. During 2023, the number of people receiving an old-age pension increased by 2.1 percent and, by

[1] The age cut-off of 65 years is also the most commonly applied definition internationally, although age 70 is also often used. In the latter case, the working age population would be defined as those aged 20-69.

December 2023, totalled over one million people. The youth dependency ratio (YDR) is defined as the number of people aged 0–19 divided by the same denominator as is used for the OADR, i.e., the population aged 20–64.

Figure 1.10 Total, old-age, and youth dependency ratios, registered 1900-2024 and projected 2025-2060

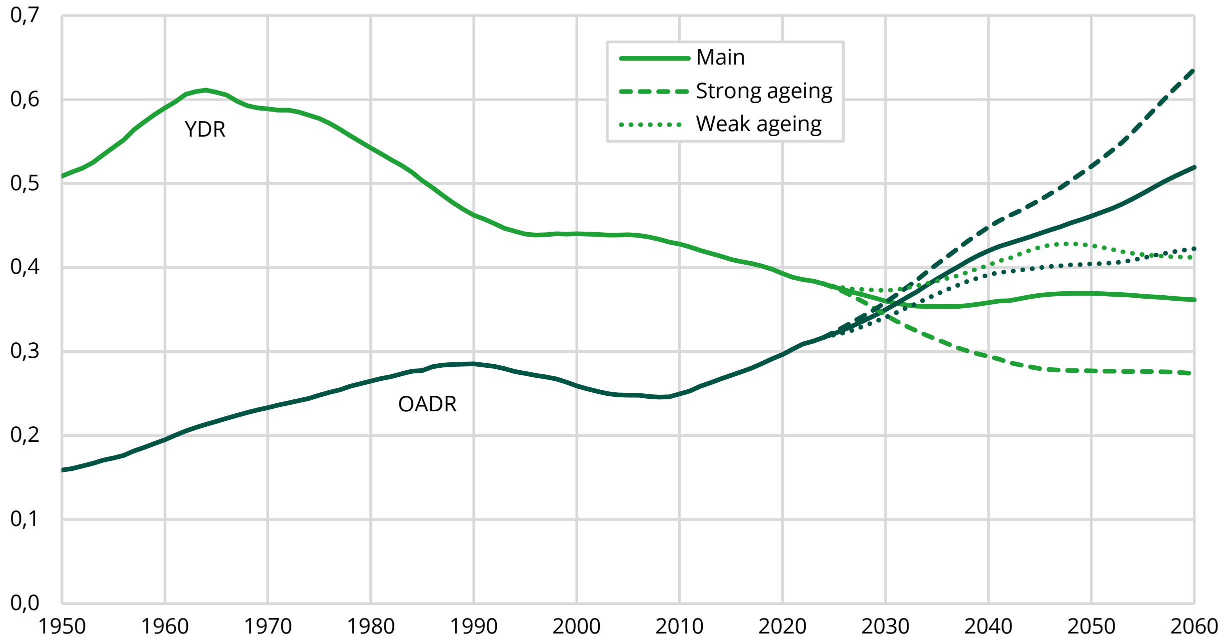


[1] The dependency ratio is the number of young (0-19 years) and/or old (65+) divided by the number of working age persons (20-64 years).
Source: Statistics Norway

High dependency ratios imply a society with a large number of young or old people in relation to the number of people of working age. Figures 1.10 and 1.11 show the development in these two dependency ratios. Currently, the YDR is slightly higher than the OADR: Every person of working age must on average support 0.4 younger persons and 0.3 older persons. After 2030, the OADR will exceed that of the YDR in our main alternative (Figure 1.11). By 2050, every person of working age will have to support on average 0.4 younger persons and 0.5 older persons. While the future YDR undulates around values that are only marginally lower than the levels seen today, the OADR increases over time, with the overall dependency ratio peaking at a one-to-one relationship in the early 2080s. As shown in Figure 1.11, by 2050, the OADR increases and exceeds 0.4 even in the weak ageing alternative. In the strong ageing alternative, it rises to above 0.5 by 2050, increasing strongly thereafter.

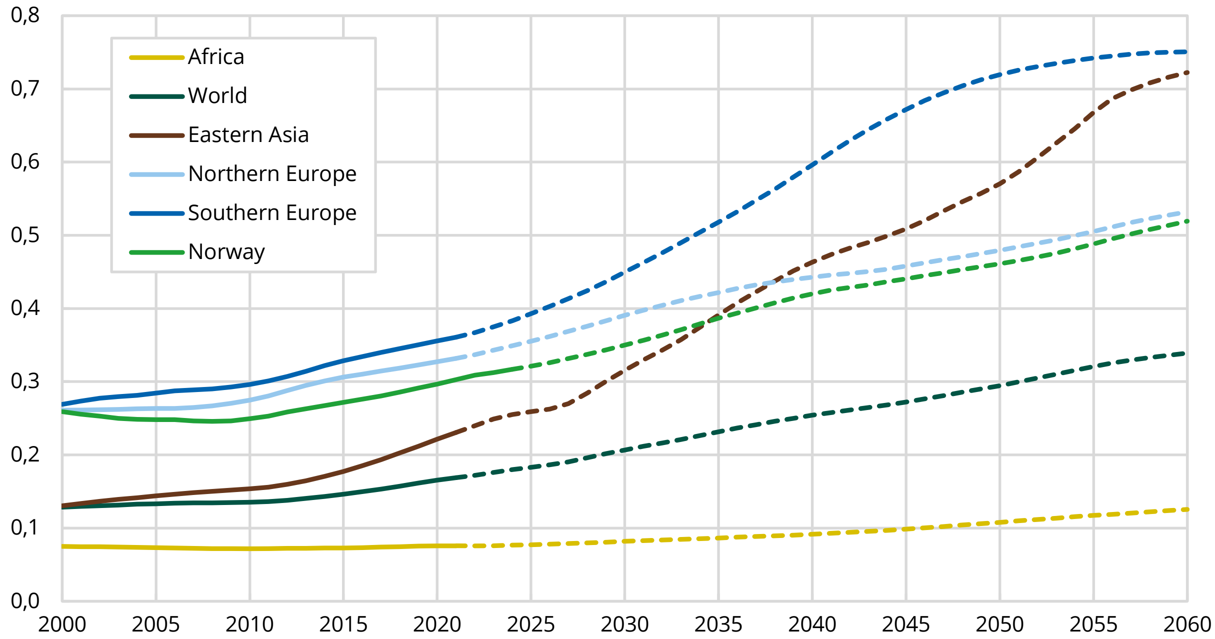
Although the OADR will increase markedly in Norway, the challenges associated with a relative decline in the working age population and the relative rise in the older-age population will be much greater elsewhere. Figure 1.12 reveals Norway to have a lower OADR than Northern Europe and Southern Europe. While Eastern Asia has a low OADR today, it is set to increase greatly due to improvements in life expectancy and the prolonged and very low fertility recorded in previous decades. Indeed, the OADR in Eastern Asia will surpass the OADR in Norway within a couple of decades. Southern Europe is also set to see a strong increase in the OADR. In Africa, where fertility remains relatively high, a much weaker increase in the OADR is expected throughout this century.

Figure 1.11 Youth and old-age dependency ratios, registered 1950-2024 and projected 2025-2060 in three alternatives[1]



[1] The numerator is the dependents. For youth, age 0-19, and for old age, age 65 or older. The denominator is the working age population, here defined as age 20-64.
Source: Statistics Norway

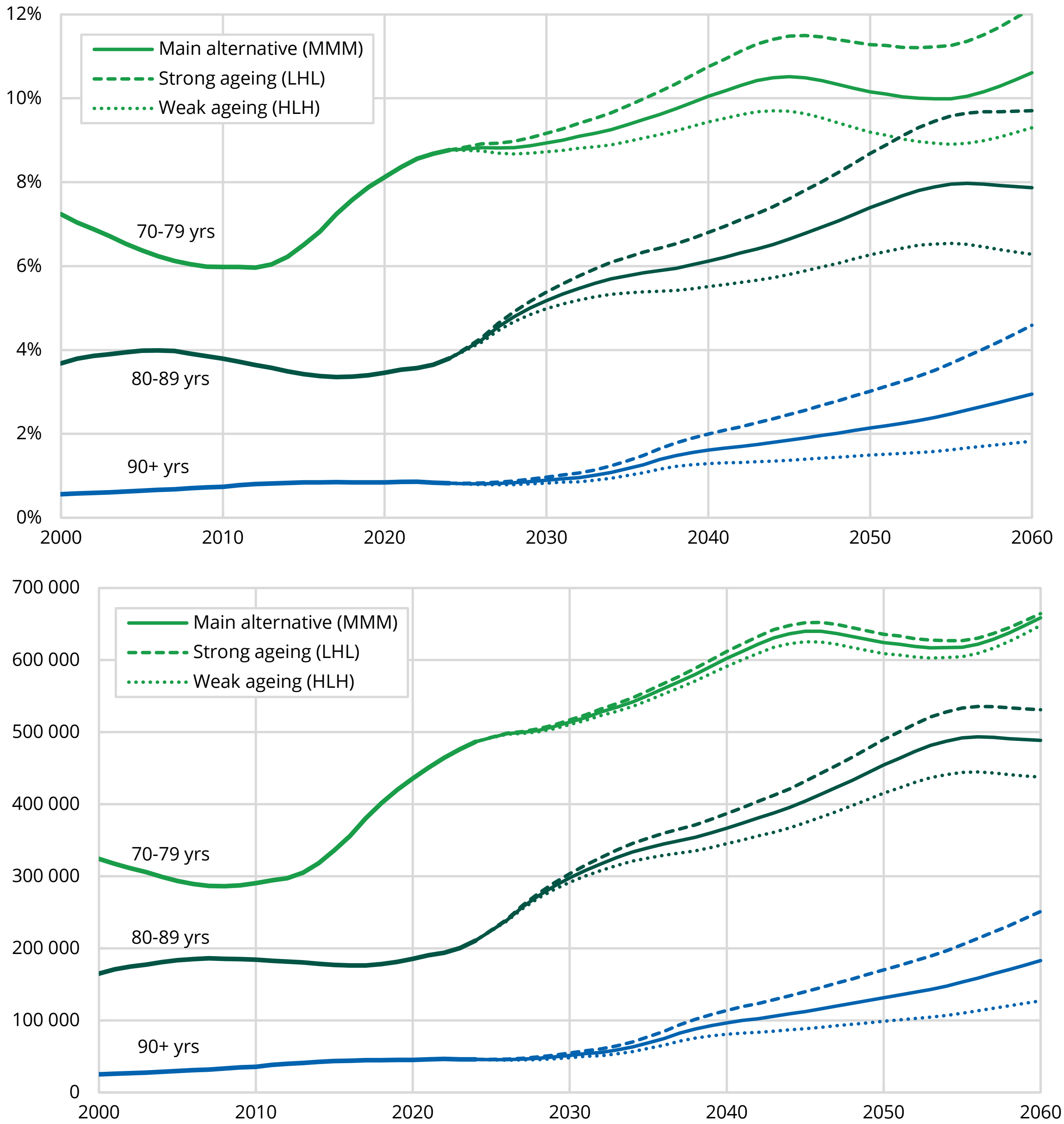
Figure 1.12 Old-age dependency ratios, registered 2000-2021 and projected 2022-2060 for selected world regions and registered 2000-2024 and projected 2025-2060 for Norway[1]



[1] Old-age dependency ratio is defined as the number of persons aged 65+ divided by the number of persons aged 20-64. United Nations medium variant (United Nations 2022) and Statistics Norway's main alternative (MMM).
Source: United Nations and Statistics Norway

Figure 1.13 shows the numbers and proportions of the population in the oldest age groups, registered and projected in the main (MMM), strong (LHL), and weak ageing (HLH) alternatives. There will be a clear increase in the proportions aged 80–89 and 90 and over, whatever the alternative. The increase in the number and share of people in their 80s has started to gain real momentum as the large post-war cohorts begin to enter this age group. These birth cohorts reach their 90s in the mid-2030s.

Figure 1.13 Share (top) and number (bottom) of the population in older age groups, registered 2000-2024 and projected 2025-2060 in three alternatives



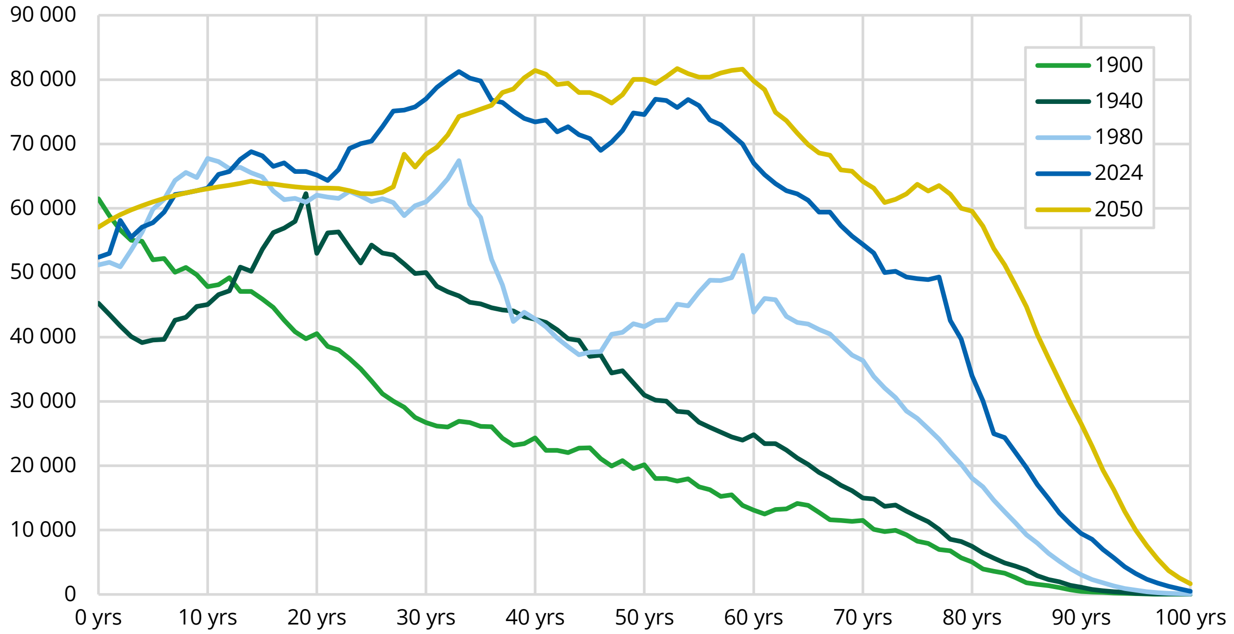
Source: Statistics Norway

The shifting age structure

The average age in Norway has increased every year for which we have figures. By 2024, the population had an average age of 41.3 years. Since 2020, the average age has increased by almost a full year. Over this same period, we have observed a decline of almost 25 000 in the number of children aged under 10, while the number of persons aged 80-89 has increased by 25 000, and this group is also where we find the largest increases in percentage terms.

Figure 1.14 shows the population's age distribution in selected years from 1900, as well as the projected main alternative distribution for 2050. For more than a century, the number of Norway's youngest inhabitants has barely changed. In the older age groups, however, we see a marked growth.

Figure 1.14 Age distributions of the population for selected years, registered and projected, main alternative (MMM)



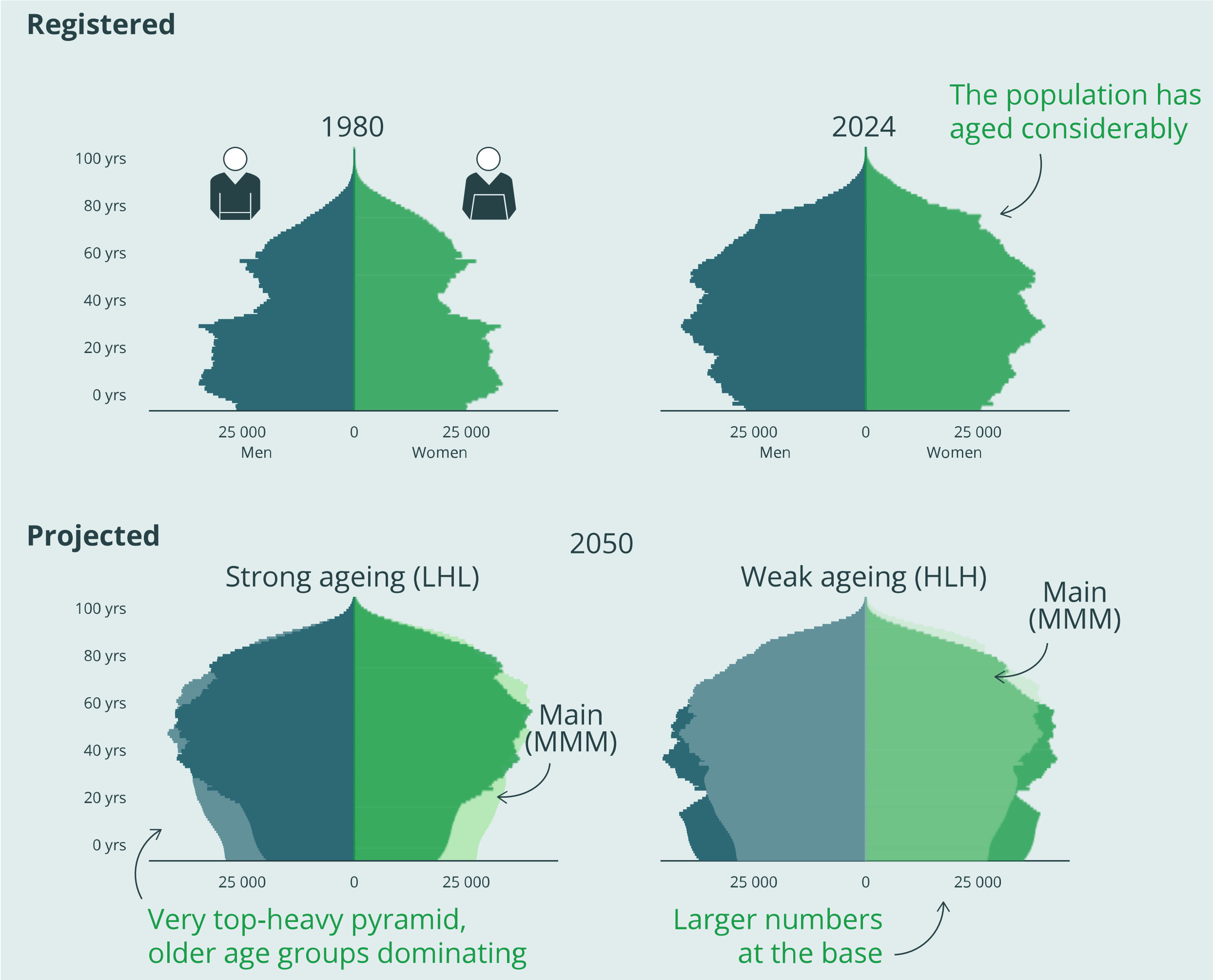
Source: Statistics Norway

Figure 1.14 also demonstrates the relative size of different birth cohorts. On the 2024 line (dark blue), we see a local peak at age 77. This represents the 1946 birth cohort, which is the largest cohort ever born in Norway. This peak can also be seen in the line for 1980 (at age 33). This cohort remained the largest through the 1950s and 1960s, until international migration and mortality took effect and the 1969 birth cohort emerged as the largest. Today, the 1990 cohort is the largest. In the coming decades, the 1990 cohort will remain Norway's largest, until the cohort born when fertility last peaked, in 2009, eventually overtakes it.

Population pyramids

Figure 1.15 shows four different population pyramids. The first pyramid (top left) shows the age and sex distribution of the population 44 years ago, in 1980. We observe the local peaks mentioned above. More strikingly, however, is the young age structure. The pyramid has a broad base, and a narrow top. The 2024 population pyramid (top right) shows that the population has aged considerably, although there are still relatively few in the very oldest of old ages. When we move forward to 2050 (bottom), we see that the population pyramids vary depending on the assumptions we use for fertility, mortality, and immigration, though all alternatives show pronounced future ageing. The main alternative (MMM) has a larger share of people in the older age groups than the weak ageing alternative (HLH), where fertility, mortality, and immigration are all high. Indeed, the weak ageing alternative is characterised by larger numbers at the base of the pyramid. In contrast, the strong ageing alternative (LHL), where fertility, mortality, and immigration are all low, shows a very top-heavy pyramid. The base is very narrow with few persons in the young age groups, and older age groups dominating.

Figure 1.15 Population pyramids, 1980, 2024, and 2050, registered and projected in three alternatives[1]



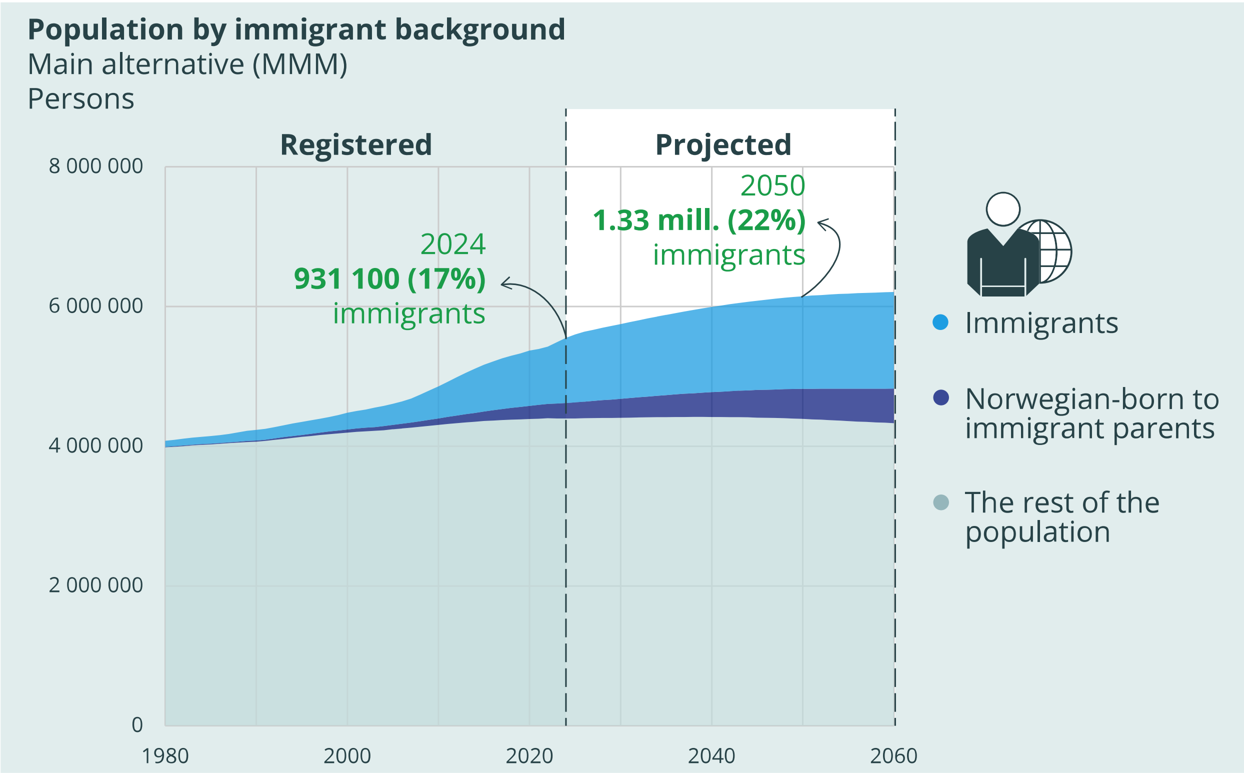
[1] The alternatives shown are: Main alternative (MMM); weak ageing (HLH); and strong ageing (LHL).
Source: Statistics Norway

1.3. A larger, more established, and older immigrant population

In the main alternative of the population projections (MMM), we have assumed higher immigration than emigration throughout the projection period. This contributes to an increase in the number of immigrants in Norway. Figure 1.16 shows the population by immigrant background in the main alternative. By 2050, the number of immigrants will increase from around 931 100 today, to near 1.33 million in the main alternative. This corresponds to more than a 40 percent increase. Over the same period, the main alternative projects the number of Norwegian-born to two immigrant parents to almost double, increasing from around 221 000 today, to around 430 000 in 2050.

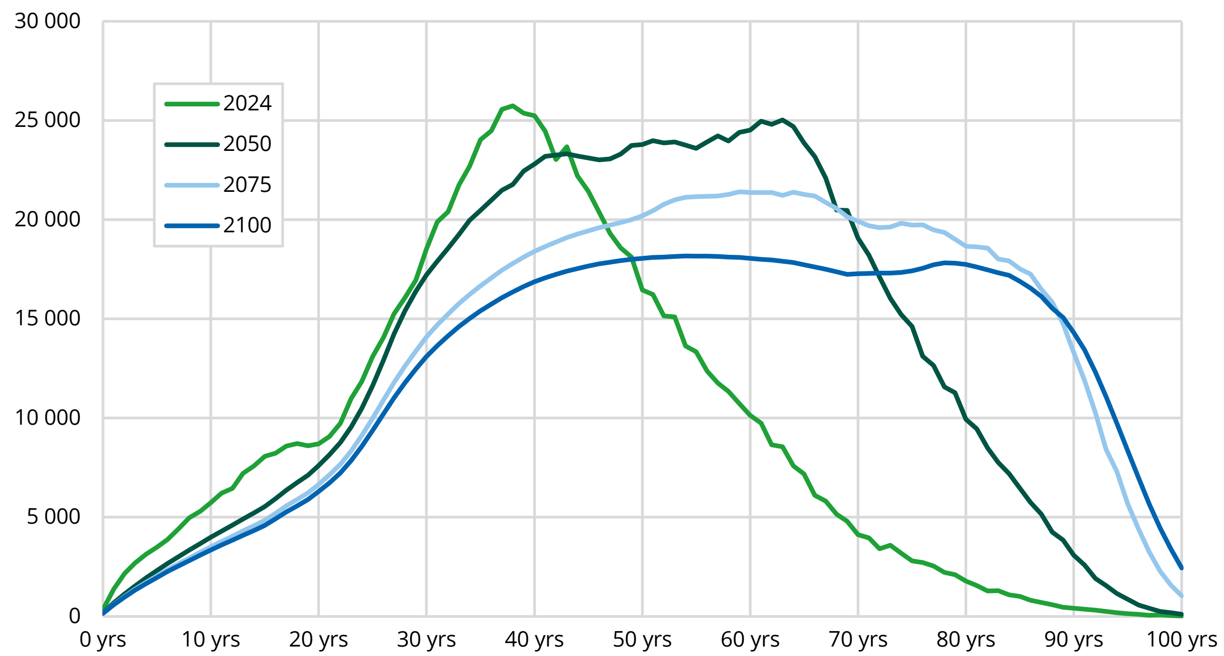
The longer a person has been living in Norway, the less likely he or she is to emigrate. As a consequence, we observe a gradual increase in the number of immigrants with long durations of stay. Today, 33 percent of immigrants have lived in Norway for more than 15 years. By 2050, the main alternative expects this share to have approximately doubled, to 67 percent, while by 2070 the share is expected to be as high as 72 percent. In line with the gradual shift to a more established immigrant population with longer durations of stay, the number of immigrants in older ages is expected to rise. The projected rightward shift in the age profile of the immigrant population is shown in Figure 1.17. In the main alternative (MMM), population growth among immigrants in Norway is confined to age groups above 40 years in 2050, and above 50 years by 2100. Figure 1.18 reveals that the majority of older immigrants will have a background from Asia, Africa, South and Central America or Eastern Europe outside the EU.

Figure 1.16 The population in three groups by immigrant background, registered 1980-2024 and projected 2025-2060



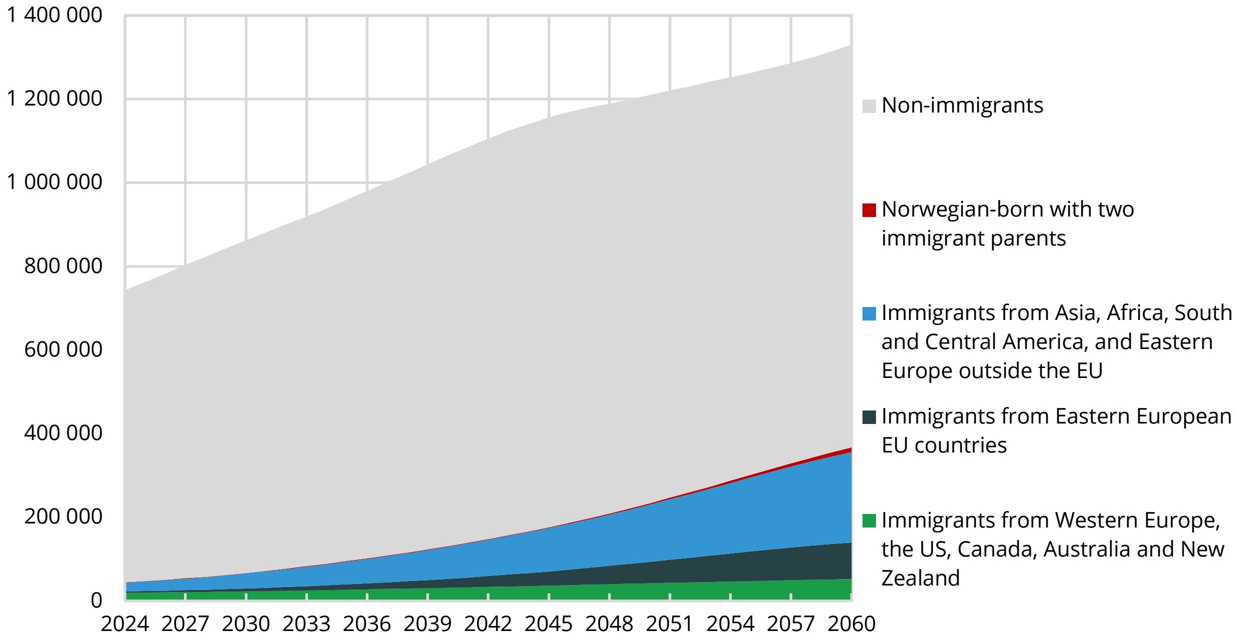
Source: Statistics Norway

Figure 1.17 Immigrants in Norway by age, registered 2024 and projected in 2050, 2075, and 2100, main alternative (MMM)



Source: Statistics Norway

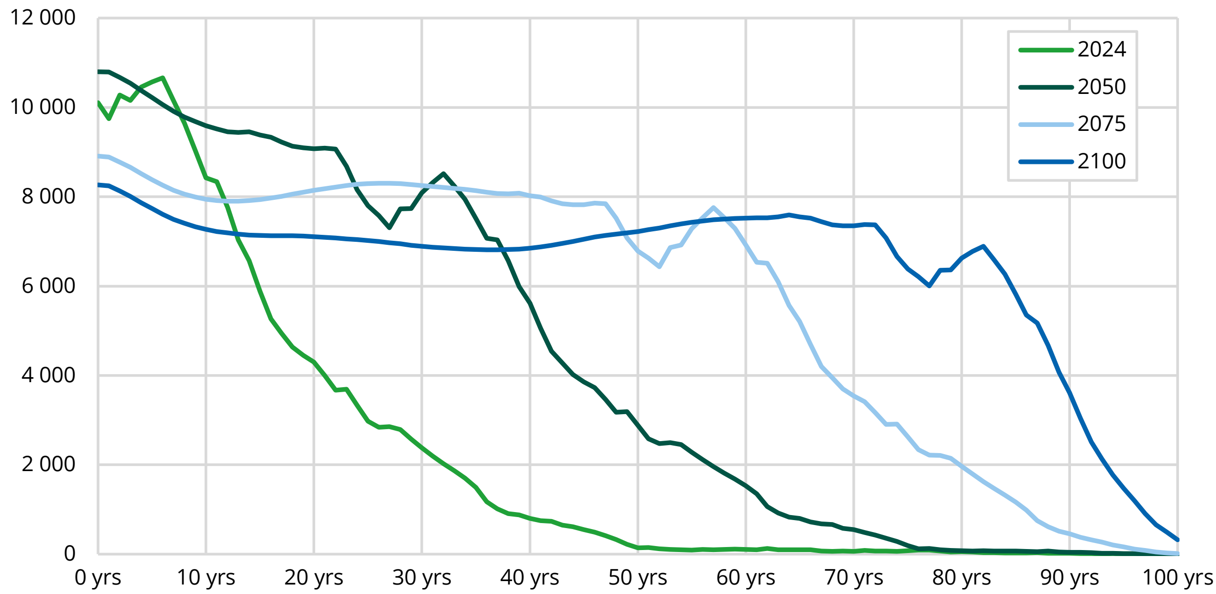
Figure 1.18 The population aged 70 or older by immigrant background, registered 2024 and projected 2025-2060, main alternative (MMM)



Source: Statistics Norway

Figure 1.19 presents the projected rightward shift in the age distribution of the children of immigrants. Today, the children of immigrants are a young group, but over the next decades this group will come of age, with strong growth taking place in the working ages and, in the latter part of the century, older ages. Chapter 7 provides more information on the projected numbers of immigrants and their descendants by, for example, duration of stay and country group.

Figure 1.19 Norwegian-born children of immigrants by age, registered 2024 and projected 2050, 2075, and 2100, main alternative (MMM)



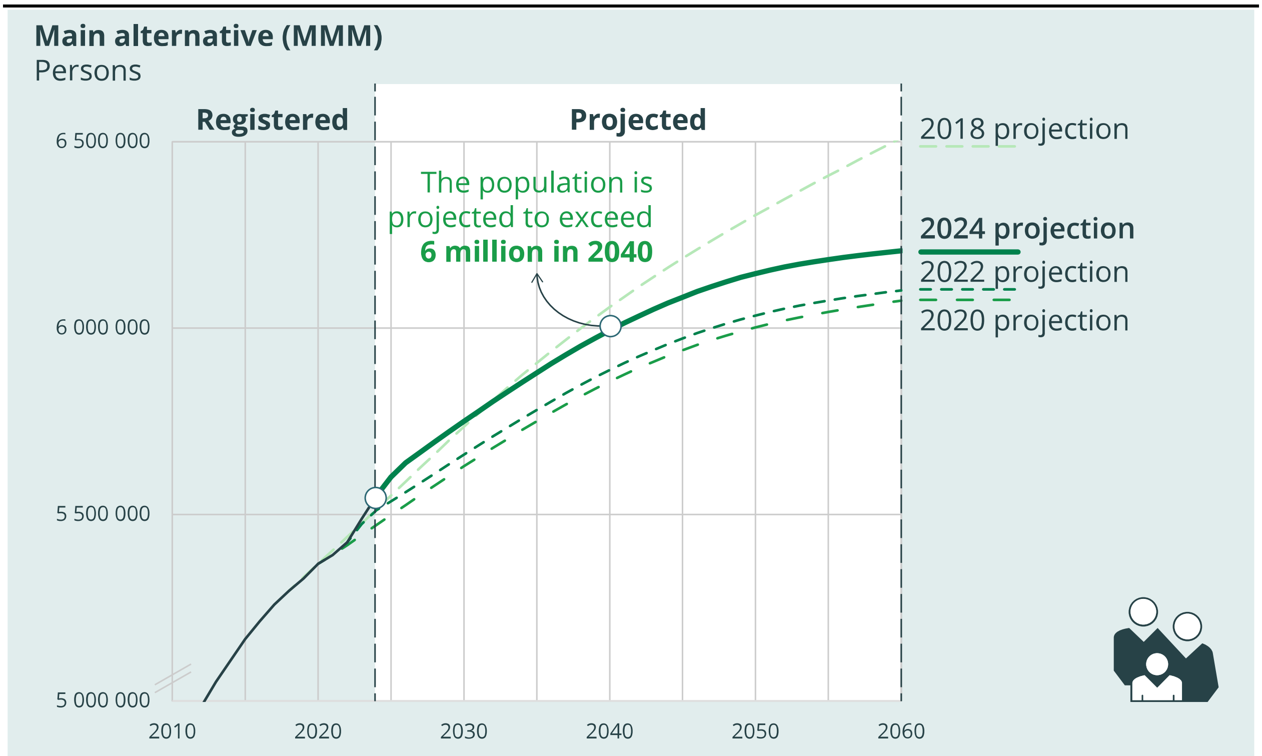
Source: Statistics Norway

1.4. Comparisons with previous projections

Figure 1.20 illustrates how the total population in the main alternative of the 2024 projections differs from that of previous projection rounds. The projected population growth in Norway is considerably lower than was projected in 2018. This is because we now assume lower long-run immigration, fertility, and life expectancy. The projected growth in the current projections is slightly higher than was published in 2020 and 2022, primarily due to a higher level of both short and longer-run immigration in the 2024 projection round. The long-run medium assumptions for life expectancy and fertility are lower in the 2024 projections than in the 2022 projections. In this year's projections, we expect the population to reach 6 million in 2040.

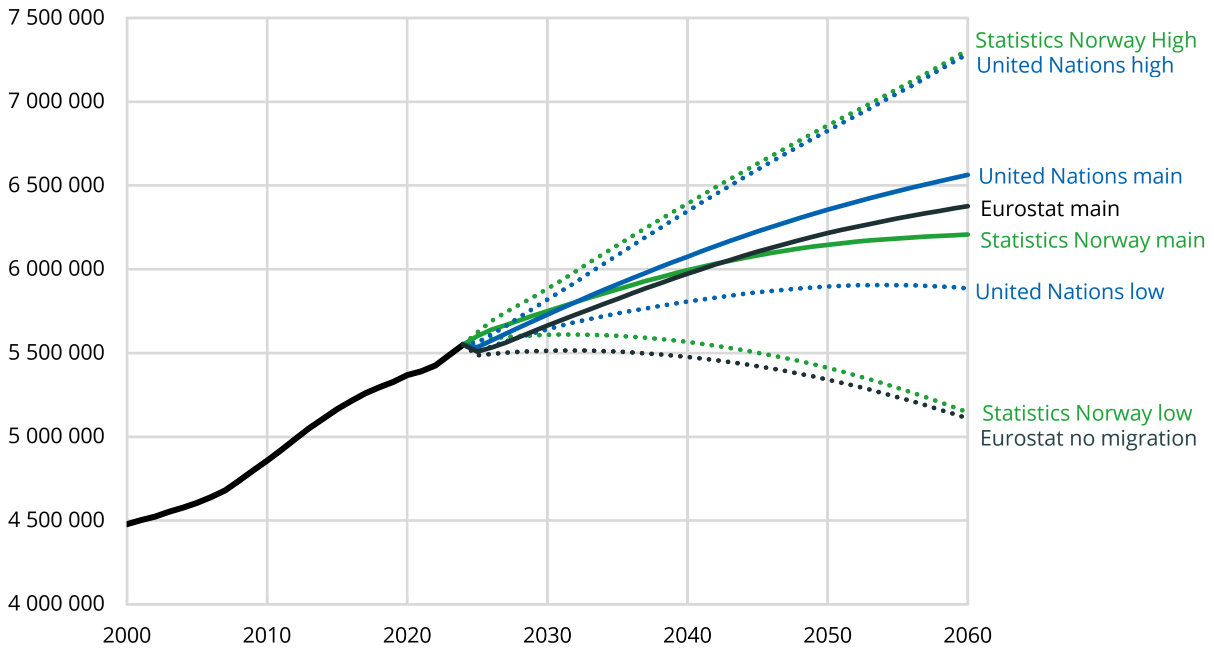
If we compare Statistics Norway's 2024 projections to the population projections for Norway made by the United Nations (2022) and Eurostat (2023), we see the long-term total population in our main alternative is lower than the main projection alternatives from the international agencies (Figure 1.21). By 2050, the United Nations medium variant projects a population of around 6.4 million, while Eurostat's baseline scenario is approximately 6.2 million. These higher population estimates are largely driven by higher long-term net migration assumptions in the UN and Eurostat projections (see Chapter 7). For the other demographic components, the UN and Eurostat project lower long-run fertility (see Chapter 5), similar long-run female life expectancy, and lower long-run male life expectancy (see Chapter 6) than we do.

Figure 1.20 Projected population from the 2018, 2020, 2022, and 2024 population projections



Source: Statistics Norway

Figure 1.21 Population in Norway, registered 2000-2024 and projected 2025-2060 by Statistics Norway, United Nations, and Eurostat[1]



[1] The United Nations (2022) reflect the 'main variant', 'high-fertility variant' and 'low-fertility variant'. For Eurostat (2023), there is only one alternative ('no migration') in addition to the baseline ('main').
Source: United Nations, Eurostat, and Statistics Norway

1.5. Uncertainty

Projections of the future population and its composition are inherently uncertain. As shown in Figure 1.1, the uncertainty increases the further into the future we look. Generally, uncertainty is greater when projections refer to small population sub-groups, such as specific immigrant population groups by age, sex, and duration of stay, and to people who are not yet part of the population. Future immigration is subject to the most pronounced degree of uncertainty, but trends in fertility, mortality, and emigration can also end up rather different than expected (Thomas et al. 2022). The assumptions used in projections determine the outcomes of the different alternatives, as evidenced by the variations between the different alternatives and the disparities between our projections and those developed for Norway by other institutions. This is discussed in more detail in Chapter 8.

Accuracy of the 2022 national projections

We now have two years of observed data from which we can compare the estimates of the previous population projections, released in July 2022 (Table 1.3). In the main alternative, the population growth was underestimated by 14 000 for the first year and by 25 000 in the second year. The deviation for the total population on 1 January 2024 was thus -39 000 persons. The primary source of this deviation was the underestimation of immigrations, which emerged as a result of a larger number of displaced persons from Ukraine arriving in 2022 and 2023 than was projected. The discrepancies in births, deaths, and emigrations were far smaller. The projected number of births was 3 200 higher than the actual number of births in 2022, and 2 600 higher in 2023. We had projected a total fertility rate (TFR) of 1.5 in 2022 and 1.49 in 2023, whereas the TFR actually fell to 1.41 in 2022 and 1.40 in 2023. The number of projected deaths in 2022 was 3 600 lower than was registered, and thus approximately compensated for the discrepancies in the number of births. In 2023, the number of projected deaths was 1 500 lower than registered. Emigrations were lower than projected in both years, by 2 700 in 2022 and 3 100 in 2023.

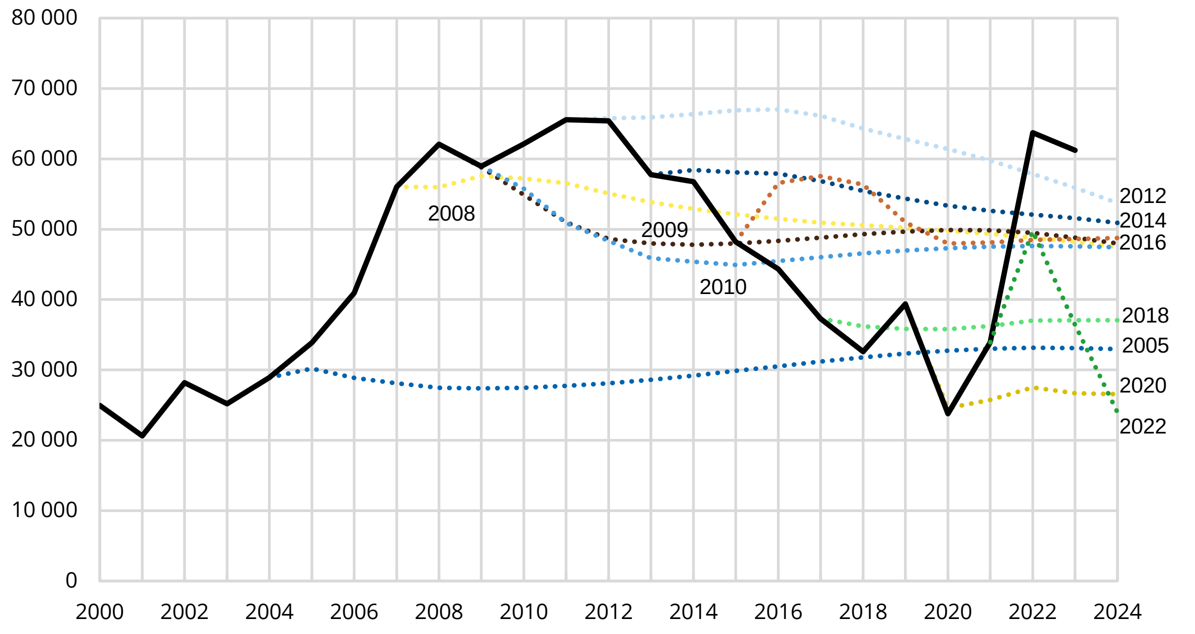
Table 1.3 The 2022 projections, comparing projected and registered figures for the first two years[1]

	2022			2023		
	Projected	Registered	Deviation	Projected	Registered	Deviation
Births	54 700	51 480	3 207	54 600	51 980	2 606
Deaths	42 200	45 774	-3 560	42 300	43 803	-1 492
Immigrations	67 100	90 475	-23 349	55 100	86 589	-31 467
Emigrations	29 900	32 536	-2 661	31 000	34 011	-3 052
Population growth	49 800	63 714	-13 994	36 400	61 219	-24 775
Population at year-end	5 475 000	5 488 984	-13 994	5 511 400	5 550 203	-38 769

[1] Immigrations and emigrations exclude persons who immigrate and emigrate during the same calendar year. The figures are thus not directly comparable to the official statistics. The actual figures for births, deaths, immigrations, and emigrations do not sum exactly to the population growth figures. Population growth is defined as the change in population size from one year to the next. Rounded figures are shown for projected numbers to underscore the uncertainty. All deviations are calculated using exact projected and registered figures.
Source: Statistics Norway

Figure 1.22 shows the population growth in Norway, registered and projected according to the main alternatives produced since 2005. The population growth projected in 2005 was consistently lower than realised, primarily because of the unanticipated rise in immigration that resulted from the eastward expansion of the European Union. If we exclude the recent sharp increase associated with the arrival of Ukrainian refugees, the projections produced between 2008 and 2018 have typically been too high. This is largely a result of too high assumptions for the subsequent developments in fertility and immigration. The short-term effect of COVID-19 travel restrictions led to a sharp decline in population growth in 2020, while the large inflow of Ukrainians in 2022 and 2023 led to a sharp increase in population growth. The timing and effect of such shocks are extremely difficult to predict. In the absence of future shocks, it is likely that annual population growth will move closer to the levels assumed in previous projection rounds.

Figure 1.22 Population growth in absolute numbers, registered (solid line) and projected 2005-2025, main alternatives[1]



[1] The years in the figure refer to the release of the respective projections.
Source: Statistics Norway

2. About the population projections

2.1. An overview of the report

Chapter 1 presented the main results from this year's population projections. In this chapter we provide a general introduction to population projections followed by a more specific discussion of those produced by Statistics Norway. Chapter 3 describes the BEFINN model used to project the Norwegian population, while Chapter 4 provides a summary of the assumptions used to produce the projections. In Chapters 5-7, we explain how we arrive at the assumptions concerning fertility, mortality, and immigration and emigration. In Chapter 8, we discuss the uncertainty associated with population projections, both generally and more specifically with regards to sources of uncertainty in Statistics Norway's projections. Finally, we offer some brief conclusions (Chapter 9).

2.2. What are population projections?

Every two years, Statistics Norway projects the Norwegian population at the national and regional levels. For the 2024 projections, the national and regional projections are published separately. This report documents the model, assumptions, and results pertaining to the national projections.

To project the population at the national level, we use the BEFINN model. This model projects the population by age and sex at the national level up to and including the year 2100. Immigrants from three country groups, Norwegian-born children with two immigrant parents, and the rest of the population are projected as separate groups. Immigrants are also projected by duration of stay, based on when they first immigrated to Norway.

Box 2.1 Population projection or population forecast?

A population projection is a calculation of the size and composition of a future population, usually by age and sex, but sometimes also by place of residence or other characteristics such as immigration category and country background. Projections are made by applying assumed probabilities or rates for future fertility, mortality, immigration, and emigration to the population by age and sex, along with other relevant characteristics used in the specific projection. The extent to which an assumption can be deemed realistic can vary. The term 'projection' is used for any estimate of the future population, including less likely ones.

A population forecast, or prognosis, is a calculation of a future population based on the assumptions that are considered most likely. Statistics Norway publishes several projections, but our main alternative (MMM), which assumes the medium level for each component, is the one we assume to be most plausible. Other terms include 'plan', which denotes a desired development, and 'scenario', which is used to refer to a description of a possible future development or an action plan based on specific assumptions (de Beer 2011).

2.3. The production process

To project the population, we must make assumptions about future fertility, mortality, immigration, and emigration. In addition, we need figures for the baseline population, which are sourced from Statistics Norway's population statistics. The projection work is thus organised around four areas:

- Fertility
- Mortality
- Immigration and emigration
- Aggregation

In each projection round we must update the time series with new data in each of these areas, assumptions need to be calculated in the form of age and sex-specific rates/probabilities, and input data for the models must be quality assured. The aggregation work also includes updating the baseline population and running the BEFINN model to generate the projections. For more details on the workflow and technical solutions in the BEFINN model, see Thomas et al. (2020).

2.4. Data

The population projections use aggregated individual-level data on population size, births, deaths, and international migration from Statistics Norway's population statistics (BESTAT), which is retrieved from the Norwegian Tax Administration for the National Population Register. No Norwegian population data are collected specifically for the purpose of developing population projections. Additional data on, for instance, the development in fertility, life expectancy and migration, causes of death, economic development in various parts of the world, as well as international demographic projections are collected and used to help shape the assumptions. This is described in more detail in Chapters 5–7.

The population statistics, on which the projections are based, only include persons who are registered as residents in the National Population Register. This includes persons who reside permanently in Norway, as well as persons who plan to reside in Norway for six months or longer and hold a valid residence permit. Since 1956, Nordic citizens have gained residency automatically. The same now applies to all citizens from the EEA and/or EFTA countries. With that said, many individuals work in Norway without being included in the statistics, particularly those on short-term contracts. There are also those who reside in Norway without a permit. Beyond this, the population statistics include persons who have moved abroad but have not registered this move. Consequently, it is the *de jure* population, and not the *de facto* population, that is projected. For more details on criteria for residency and emigration, please refer to the English publication by Zhang (2008) and the English abstract in the report by Pettersen (2013). A more recent Norwegian-language report by Krokedal et al. (2024) is also informative.

2.5. Publications and output

The main results of the national population projections are presented in a press release at https://www.ssb.no/en/folkfram. The StatBank (https://www.ssb.no/en/statbank/list/folkfram) provides projected population figures and changes in the population based on various demographic characteristics (see Table 2.1). Assumptions about fertility, mortality, immigration, and emigration, as well as the results of the projections, are also presented in reports and articles in Norwegian and English.

Table 2.1 Tables from the population projections available online at Statistics Norway's StatBank[1]

Table title	Content	Model
Population projections 1 January, by sex, age, immigration category and country background, in 15 alternatives	Total population	BEFINN
Projected number of immigrants 1 January, by country background and duration of stay, in 5 alternatives	Total population	BEFINN
Projected population changes, by immigration category and country background, in 9 alternatives	Births, deaths, immigration, emigration and net migration	BEFINN
Projected fertility rate, by immigration category and country background, in 3 alternatives	Total fertility rate	BEFINN
Projected life expectancy, for men, women and both sexes combined, by age in 3 alternatives	Life expectancy and remaining life expectancy	Lee-Carter/ARIMA2
Projected probability of death (per 1 000), by sex and age, in 3 alternatives	Probability of death	Lee-Carter/ARIMA

[1] The population counts are per 1 January, whereas the component information pertains to the entire year in question.
[2] ARIMA is short for 'Auto-Regressive Integrated Moving Average'.
Source: Statistics Norway

2.6. Users

The main users of Statistics Norway's national population projections are public and private planners, central government, as well as journalists, researchers, politicians, and the public. The projections are also used internally at Statistics Norway as input in macroeconomic models such as KVARTS, DEMEC, and SNOW, as well as in the microsimulation model MOSART. Beyond this, the national projections are used as input in BEFREG, the regional population projection model, and in the projection models ADMOD, LÆRERMOD and HELSEMOD.

Statistics Norway regularly reports their assumptions and projection results to international agencies, including Eurostat and the United Nations, while helping quality assure nowcasts and projection results from Eurostat.

2.7. Regulations

The regional and national population projections are founded on the Act on Official Statistics and Statistics Norway (Ministry of Finance 2019). This is a revision of the Norwegian Statistics Act of 1989. The revised Statistics Act mandates the implementation of a national programme for official statistics and the regional and national population projections are included in this programme (Statistics Norway 2021).

There is no EU regulation in this area, but there is a collaboration between Norway and Eurostat. Eurostat regularly makes population projections for EU and EFTA member countries, including Norway (Eurostat 2023). Eurostat follows the code of practice for European statistics (Eurostat 2017) and has drawn up guidelines for reporting and communication that the Norwegian national projections adhere to (Eurostat 2018). The United Nations has also drawn up guidelines for the communication of population projections (United Nations 2018), and these guidelines are considered when Norwegian population projections are published.

In summary, the population projections are produced and published in accordance with international standards. The Norwegian figures are, however, more detailed (age, year, immigration category, country group, and duration of stay) than what is commonly published by most other countries.

2.8. History

Previous population projections

Statistics Norway has produced national population projections regularly since the 1950s, with several models having been developed. Since 2005, the national population projections have utilised different versions of the BEFINN model. The original BEFINN model was designed to model the population of immigrants and their Norwegian-born children by country group. This model was employed in the 2005, 2008, 2009 and 2010 projections. Starting in 2011, the entire population by immigration category, country group and duration of stay in Norway has been projected using the BEFINN model. This model remains in use today (see Chapter 3 for details).

Projections with specific aims

Some specific projections have been published over the years:

- Regional distribution of immigrants and their Norwegian-born children (REGINN). Used only once (2012)
- Projections by marital status. Used only once (1986)
- Household projections. Used only once (1995)

Documentation of previous projections

The projections were initially published in the Statistical Yearbook of Norway series. Since 1969, various regional and national projections reports have been published, see www.ssb.no/en/befolkning/?de=Population+projections+&innholdstype=publikasjon-artikkel. Since 1996, the projections results have been published in Statistics Norway's StatBank (www.ssb.no/en/statbank/list/folkfram).

Comparability over time

Broadly speaking, the national population projections may be compared over time from 1996 onwards, although changes to the models and the data have occurred. As an example, the country groups are not entirely comparable over time, since the definition and the number of groups have varied. Over the past decade, three country groups have been used. However, the countries comprising the groups have varied somewhat. Croatia was, for instance, moved from Country Group 3 to Country Group 2 when the country joined the EU in 2013. For an overview of the current country groupings, see Appendix A.

2.9. Comparability with the official population statistics

In comparing results from the population projections with the general population statistics at Statistics Norway, two main differences stand out:

- The projection models project the population from 1 January one year to 1 January the following year. This means that individuals who move several times during the year are only recorded with one move. If a person immigrates to Norway and then emigrates from Norway, they are not recorded in the modelled estimates of migration. Consequently, somewhat fewer migrations are tallied in the population projections as compared to the numbers that are published in the general population statistics.
- The age definitions differ between the projections and the general population statistics. The projections are made for 120 age groups: 0, 1, 2, ..., 119 years. For age-specific rates for fertility, mortality, and migration, we define age in completed years at the end of the year. In the general population statistics, it is usually age at the time of the event that is used. This means that the age-specific rates and the probabilities that are used in the projections apply to a population that, on average, is half a year younger than those published in the population statistics. The same applies to life expectancy at birth and remaining life expectancy.

3. The BEFINN projection model

BEFINN employs the cohort-component method for the projection of the national population. It calculates the next year’s population by starting with the population in the current year and adding births, deducting deaths and emigrations, and adding immigrations. This is done for both sexes by one-year age groups. When the following year's population has been calculated, it is used as the basis for calculating the population the year after.

The population is projected in several different alternatives. Each alternative is described using three letters in the following order: Fertility, life expectancy and immigration. The alternative MMM indicates that the medium level is used for all the three components and denotes our main alternative. The components can also have the levels: L = low; H = high; C = constant; E = Equal in- and out-migration; or 0 = no migration. In pre-2020 projection rounds, four letters were used as these projections included internal migration, which was defined by the third letter of the four.

3.1. The cohort-component method

The cohort-component method is the most common method for projecting populations and is used by most agencies that project populations at a national or international level (Gleditsch et al. 2021).

Data and methods

We use two types of input when projecting the population using the cohort-component method:

- Updated figures for the population by sex and one-year age groups for the baseline year
- Assumptions about the future development of the demographic components (fertility, life expectancy, and international migration).

The population projections utilize aggregated individual-level data on population size, births, deaths, and international migration from Statistics Norway’s population statistics (BESTAT), collected from the Norwegian Tax Administration for the National Population Register. We employ data categorized by age, sex, immigrant background and country group for 1 January each year. No samples are used, with the projections utilizing the whole population in estimations.

Table 3.1 is useful for illustrating the cohort component method. When we have an overview of the number of men and women in each age group in the baseline year, and assumptions about the demographic components for each of these groups, we can work out how many persons there will be in each age group the year after. If, for example, we start with 14-year-old females in a given year and deduct those who are assumed to emigrate or die during the course of a year, and then add the number of 14-year-old females who are assumed to immigrate, we arrive at the number of 15-year-old females the year after. This figure is then used as the basis for calculating the number of 16-year-old females the year after that, and so on. These examples are indicated in blue in the table. A cohort can thus be followed through the projection period.[2]

This method cannot be used directly for those below age one. Indeed, to project the number of zero-year-olds, we start with the number of women in each age group between 15-49 years and combine this with the assumptions about their fertility. We then arrive at a figure for new-born boys and girls. To calculate the number of new-born boys, this figure is multiplied by 0.51369, the natural

[2] A cohort is a group of people who experience a common event during the same time period, such as a birth, marriage or graduation. In this report, we commonly refer to birth cohorts, i.e., people born in the same year.

sex ratio at birth, which indicates a slight bias towards boys. An example of the children this pertains to is indicated in green in the table.

Table 3.1 An illustration of the cohort-component method

	Number of women			
	Registered year	Projected years		
	t	t+1	t+2	t+3
Age 0	26 619	26 649	26 536	26 288
Age 1	27 165	26 870	26 907	26 804
Age 2	28 058	27 314	27 020	27 058
Age 3	29 261	28 154	27 406	27 120
Age 4	29 547	29 322	28 202	27 449
Age 5	29 721	29 601	29 356	28 224
Age 6	30 118	29 780	29 641	29 383
Age 7	30 789	30 161	29 810	29 659
Age 8	31 047	30 843	30 206	29 850
Age 9	32 041	31 099	30 894	30 256
Age 10	32 507	32 099	31 156	30 958
Age 11	32 008	32 563	32 156	31 219
Age 12	31 319	32 067	32 625	32 223
Age 13	31 494	31 377	32 126	32 690
Age 14	30 853	31 551	31 439	32 191
Age 15	30 887	30 908	31 614	31 512
Age 16	30 722	30 972	31 010	31 734
Age 17	30 367	30 789	31 055	31 107
Age 18	30 861	30 442	30 879	31 159
Age 19	32 067	30 959	30 573	31 038
Age 20	32 019	32 208	31 149	30 803
Age 21	32 005	32 193	32 432	31 418
Age 22	32 688	32 207	32 465	32 754
Age 23	33 822	32 952	32 543	32 883
Age 24	33 822	34 116	33 357	33 035
Age 25	34 470	34 163	34 553	33 933

Source: Statistics Norway

The assumptions

Most of the assumptions that are used in the cohort-component method are stated as rates, probabilities, or proportions by sex and one-year age groups. This applies to the assumptions about future fertility, mortality, and emigration. For immigration, the total assumed number of immigrations is distributed by age and sex based on the age and sex distribution observed in previous years.

Future fertility is projected based on observed trends in fertility, differing by immigration background. The fertility of women with a Norwegian background is projected separately, whereas the fertility of immigrant women is projected in 15 alternatives by combinations of country group and duration of stay in Norway (see Chapter 5). Probabilities of death and life expectancy are projected through a combination of Lee-Carter and ARIMA models (see Chapter 6). Since 2008, an econometric model has been used to project future immigration (see Chapter 7). In this model, immigration is projected based on factors like income levels, unemployment, population size of sending country groups (in broad age groups), and prior immigration to Norway from the country groups, see Skjerpen and Tønnessen (2021).

Multiple events during a calendar year

In principle, our version of the cohort-component method only calculates changes from the turn of one year to the turn of the next. This implies that there is limited possibility for the same person to experience more than one demographic event during a single year. A person cannot, for example, immigrate and then emigrate (or die or have a child) in the same year. An exception to this rule concerns new-born children: It is possible to be born and die in the same year, or to be born and emigrate in the same year. This is because of the order in which the components are entered into the model. First, births are entered, and the age of all the age groups is increased by one year. This newly projected population (including the births) is then used to calculate the number of deaths and the number of emigrations in each age group. Finally, the number of deaths and emigrations are deducted, and the number of immigrations added.

3.2. The BEFINN model

The BEFINN model projects the population at the national level, and immigrants, Norwegian-born persons with two immigrant parents, and the remaining population are projected as separate groups. Since immigrants and Norwegian-born with two immigrant parents are separate groups, separate assumptions can also be used. For fertility, separate birth rates are assumed for immigrant women from three country groups and five duration of stay groups, while Norwegian-born daughters of two immigrant parents are assumed to have the same rates as the remaining population. For mortality, the same age and sex-specific probabilities apply to all groups, regardless of immigrant background (see Chapter 6). For emigration, separate probabilities are used for immigrants, for Norwegian-born persons with two immigrant parents, and for the remaining general population. These probabilities differ, in turn, depending on immigration category and country group. For immigrants, the probability of emigration also varies with duration of stay. To be able to calculate the number of Norwegian-born persons with two immigrant parents, assumptions must be formed regarding the proportion of children born to immigrant women who will also have an immigrant father. These proportions vary between the three country groups. This is discussed in more detail in Chapters 4 and 7.

Results

BEFINN calculates the future population in Norway as of 1 January for each projection year, up to and including 2100, based on the following characteristics:

- One-year age group (0, 1, 2, ..., 119 years)
- Sex
- Immigration category
  - Immigrant
  - Norwegian-born children with two immigrant parents
  - The remaining population
- Country group, i.e., country group of birth for immigrants, and mothers' country of birth for Norwegian-born children with two immigrant parents
- Duration since first immigration to Norway (only for immigrants)

The country groups currently in use are described in Appendix A. In short, *Country Group 1* comprises all Western European countries, i.e., countries that were part of the 'old' EU (pre-2004) and/or the EEA and EFTA, as well as the US, Canada, Australia, and New Zealand. Persons from these countries display relatively similar demographic behaviour for fertility and emigration. Moreover, few or no restrictions apply to their ability to live and work in Norway. *Country Group 2* comprises the eleven new EU countries in Eastern Europe (who became EU members in 2004 or later): Estonia, Latvia, Lithuania, Poland, Czechia, Slovakia, Hungary, Slovenia, Croatia, Bulgaria, and Romania. We have merged them to form one group since it is from these countries that immigration to Norway has increased most in recent decades, while they are also the group of EU-member countries that have the largest relative income differences to Norway. The potential for migration to Norway has therefore been relatively high for persons living in Country Group 2. *Country Group 3* comprises the rest of the world, i.e., the rest of Eastern Europe, Africa, Asia (including Türkiye), South and Central

America and Oceania (excluding Australia and New Zealand). Persons from these countries must apply for a permit to live and work in Norway. This group is extremely heterogeneous, and we have primarily merged these countries into one group for the sake of simplicity.

3.3. Projection alternatives

The results of a population projection depend on the assumptions used for the components. Different assumption alternatives are therefore produced for fertility, life expectancy and immigration:

- M – medium
- H – high
- L – low
- C – constant
- E – zero net migration (i.e., equal in- and out-migration)
- 0 – no migration (no in- or out-migration, i.e., closed borders)

Statistics Norway projects the population using a total of 15 combinations of these alternatives (Table 3.2). Each alternative is described using three letters in the following order: Fertility, life expectancy, and immigration. The term 'main alternative' is used to designate the MMM alternative, which indicates that the medium level has been used for all components. In the MME alternative (zero net migration), immigration and emigration take place, but the difference between them is 0. In other words, there are as many emigrations as immigrations. In the MM0 alternative, on the other hand, there is no international migration at all, i.e., the borders are closed.

Table 3.2 Statistics Norway's population projection alternatives

Alternative	Description
MMM	Main alternative (medium national growth)
LLL	Low national growth
HHH	High national growth
HMM	High fertility
LMM	Low fertility
MHM	High life expectancy
MLM	Low life expectancy
MCM	Constant life expectancy
MMH	High immigration
MML	Low immigration
MMC	Constant immigration
LHL	Strong ageing
HLH	Weak ageing
MME	Zero net migration
MM0	No migration (closed borders)

Source: Statistics Norway

One reason why we project the population in so many alternatives is to illustrate the uncertainty associated with the projections. This is discussed in more detail in Chapter 8. For example, the alternatives with constant life expectancy or immigration, and the alternatives with no migration and/or zero net migration, are relatively unrealistic, but they can nonetheless represent interesting comparisons for analytical work. The same applies to the alternatives for high national growth (HHH) and low national growth (LLL). It is implausible that we will see a combination of high fertility, high life expectancy, and high immigration, or of low fertility, low life expectancy, and low immigration throughout the projection period.

4. Summary of assumptions

This chapter provides details of the assumptions used in the national projections, as well as the data and methods used to produce the assumptions. A summary of the key assumptions is shown in Table 4.1. In the following chapters (Chapters 5–7), we discuss the assumptions and results in greater detail and provide more substantial background information.

Table 4.1 A summary of the key assumptions[1]

	Registered 2023	Medium (M) assumption	High (H) assumption	Low (L) assumption
Total fertility rate, children per woman	1.40			
2025		1.44	1.55	1.30
2030		1.57	1.86	1.22
2050		1.66	1.91	1.21
2100		1.66	1.91	1.22
Life expectancy at birth, men	81.4			
2025		81.9	82.5	81.3
2030		82.8	83.9	81.6
2050		86.0	88.4	83.3
2100		92.1	96.3	87.3
Life expectancy at birth, women	84.6			
2025		84.9	85.4	84.4
2030		85.6	86.7	84.6
2050		88.3	90.5	85.9
2100		93.4	97.3	89.0
Yearly immigrations	86 589			
2025		63 800	87 900	45 200
2030		49 200	59 100	39 100
2050		44 200	66 400	30 000
2100		39 500	87 900	15 200
Yearly emigrations[2]	34 011			
2025		34 800	35 800	33 500
2030		32 700	35 300	30 100
2050		30 900	38 200	25 300
2100		26 300	49 600	13 900

[1] The figures on yearly immigrations and emigrations do not include persons who have moved to and from Norway (or vice versa) during the same calendar year. As such, these figures are not fully comparable with those presented in the official population statistics.
[2] The M, H, and L figures for projected emigrations are obtained from the MMM, MMH and MML alternatives, respectively.
Source: Statistics Norway

4.1. Fertility

Projected age-specific fertility rates (ASFRs) are used as assumptions for future fertility in BEFINN (see Box 4.1). The ASFRs vary depending on country group of origin, duration of stay, one-year age groups, and calendar year. The assumptions are produced in three alternatives: High (H), medium (M), and low (L) fertility.

BEFINN projects fertility for 16 different groups of women. In addition to calculating fertility for Norwegian-born women (i.e., non-immigrants), we factor in the fertility disparities between immigrant women in 15 combinations of country group of origin and duration of stay in Norway. First, we ascertain the baseline levels for the different groups via the registered data. Next, we make assumptions about how fertility will develop in the future, based on observed fertility patterns and discussion with relevant experts. Currently, no formal model is employed (Gleditsch et al. 2021).

Data

We use observed data to calculate the baseline level for fertility in the different subgroups of women. We take the number of women aged 15–49 years from Statistics Norway’s population statistics. The data also contain information on women's backgrounds, i.e., whether they are immigrants or not, and how long they have lived in Norway. Data recording live births are also obtained from Statistics Norway's population statistics.

Box 4.1 Age-specific fertility rates (ASFRs)

ASFRs are calculated by dividing the number of births to women of a given age by the mid-year population of women of the same age. The mid-year population is the average number of women of the age in question residing in the country in a given calendar year. Women are divided into one-year age groups from 15 to 49 years. Immigrant women are further divided by country background and duration of stay in Norway.

The formula for age-specific fertility rates can be written as follows:

$ASFR(x,t) = f(x,t)/k(x,t)$,

where $f(x,t)$ is the number of live births to women age x in year t, and $k(x,t)$ is the mid-year population of women age x in year t.

Total fertility rate (TFR) is the sum of the age-specific fertility rates for women aged 15–49 years in a given period, normally a calendar year. TFR can be interpreted as the average number of children each woman will give birth to, provided that the period-specific fertility pattern in the calendar year will persist and that no deaths occur before age 50. TFR is often called period fertility, as it reflects the situation in a specific year or period.

Baseline fertility

BEFINN projects the population at the national level. To do this, we need estimates for future birth rates. This is done separately for immigrant women and for the remaining population.

Fertility among immigrant women

To calculate how many children will be born to immigrant women in future, we create groups based on country group and duration of stay.

We use three country groups (see Appendix A for a detailed list):

- Country Group 1: Western Europe, the US, Canada, Australia, and New Zealand
- Country Group 2: Eastern EU member countries (Bulgaria, Estonia, Croatia, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, Czechia, and Hungary)
- Country Group 3: The rest of the world, i.e., the rest of Eastern Europe, Africa, Asia (including Türkiye), South and Central America and Oceania (excluding Australia and New Zealand)

Duration of stay is calculated as the number of whole years since first-time immigration to Norway. We divide duration of stay into five groups:

- 1 year or less
- 2–3 years
- 4–6 years
- 7–11 years
- 12 years or more

Together, this amounts to 3 x 5 = 15 combinations of country group and duration of stay. To find the baseline level for fertility in the 15 different groups of immigrant women, age-specific fertility rates are calculated for each group as an average of the last ten years. This is a weighted average where the last year with available data counts most.

Fertility among the rest of the population
The remaining population is non-immigrant women, including those who are Norwegian-born with two immigrant parents. To calculate the baseline level for fertility among this group, ASFRs are calculated according to observed data for the last registered year (2023 in this projection round).

Fertility assumptions
For each year in the projection period, we use a factor that adjusts the baseline ASFRs up or down based on how we assume fertility will develop in the future. The annual factor is created in three alternatives (low, medium, and high) and is applied to all the ASFRs in the given year. As such, we do not account for changing age schedules. The factors are set by Statistics Norway after discussions with an advisory reference group consisting of fertility researchers.[3]

When we set the factors, the fertility of women with a Norwegian background (i.e., non-immigrant women, including those who are Norwegian-born with two immigrant parents) is used as the point of departure. For example, we can envisage the total fertility rate among this group of women to be 1.64 in 2040 – around 18 percent higher than the 1.39 observed in 2023. The factor will then upwardly adjust the age-specific fertility rates for all groups of women, so that they are around 18 percent higher in the year 2040 than in 2023. This means if women from Country Group 3 with a 4–6-year duration of stay had a TFR of 2.1 in 2023, the projected TFR of that group would be 2.48 in 2040, corresponding to an 18 percent increase.

Since the same factor is used for all groups of women, one might assume that the differences in fertility between the immigrant women from each of the three country groups and the remaining women would be constant throughout the projection period. They are not. This is because immigrant women's fertility varies with their duration of stay, and because the number of immigrant women in different groups varies over time. During the projection period, most immigrant women will switch duration-of-stay groups several times, so that the composition of the 15 groups of immigrant women changes. This has consequences for how many women can potentially give birth in each duration-of-stay group, as well as for how fertility will develop among immigrant women overall. As such, the projected total fertility rate will not be constant as the composition of the different groups of women will change over time. The recent development of the total fertility rate for immigrants from each country group is shown in Figure 4.1.

Based on expert input and assessments of different fertility trends, our main alternative (MMM) suggests that the TFR for non-immigrant women will start to increase from its historical low in 2023, reaching 1.54 children per woman by 2030 and 1.64 by 2035, after which it remains constant. For all women combined, this results in a TFR of 1.57 in 2030 and 1.66 in 2035. Thereafter, overall TFR remains approximately constant, with some deviations occurring as a result of compositional shifts across the population categories. In the low fertility alternative, we set the TFR for non-immigrant women to decline to a constant level of 1.20 from 2027 onwards. This corresponds to a constant long-run TFR of 1.21 for all women combined. In the high fertility alternative, we project the non-immigrant women TFR to increase to 1.89 after 2030, and from there it remains constant. This corresponds to an approximately constant long-run TFR of 1.91 for all women.

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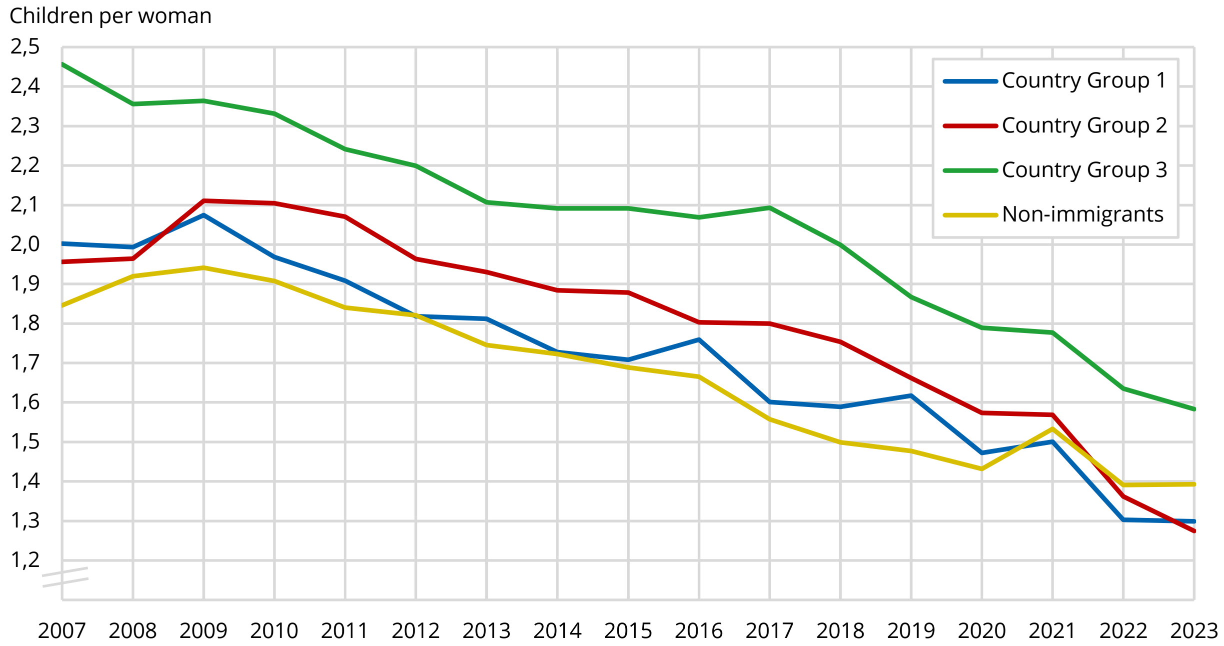
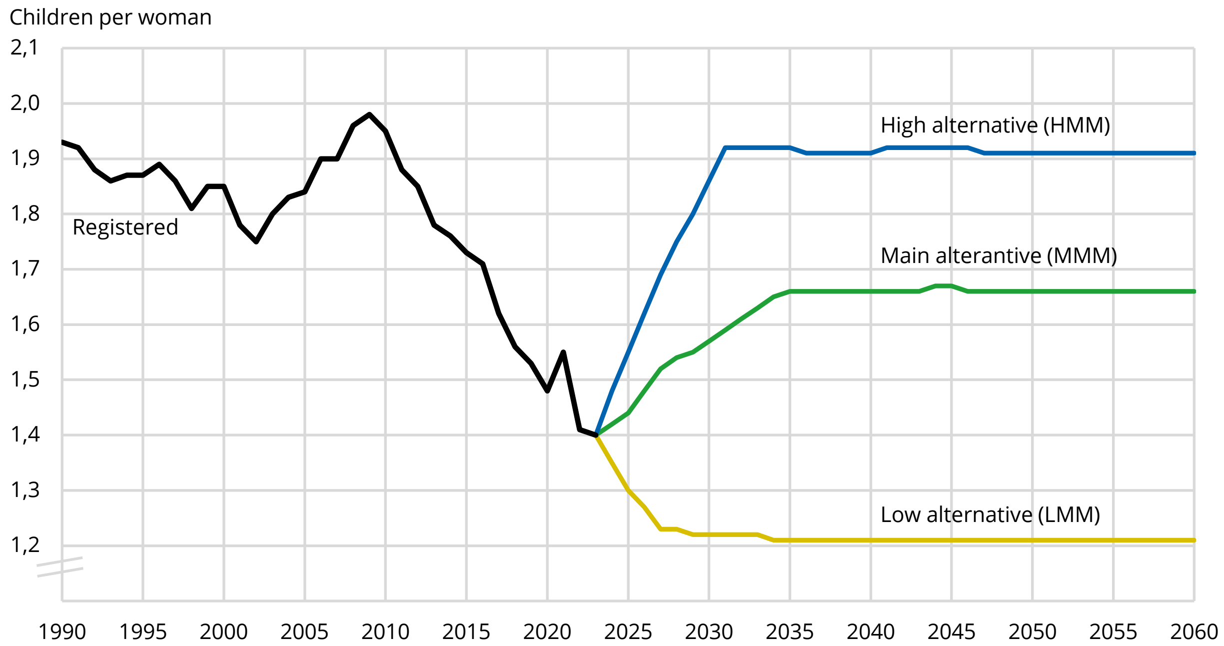
[3] This year's reference group consisted of the following members (listed alphabetically with associated organization in parentheses): Janna Bergsvik (Statistics Norway), Lars Dommermuth (Statistics Norway), Siri Eldevik Håberg (Norwegian Institute of Public Health), Øystein Kravdal (Norwegian Institute of Public Health), Trude Lappegård (University of Oslo), Lena Lundqvist (Statistics Sweden), and Vegard Skirbekk (Norwegian Institute of Public Health).

Figure 4.1 Total fertility rate in Norway by country group, 2007-2023



Source: Statistics Norway

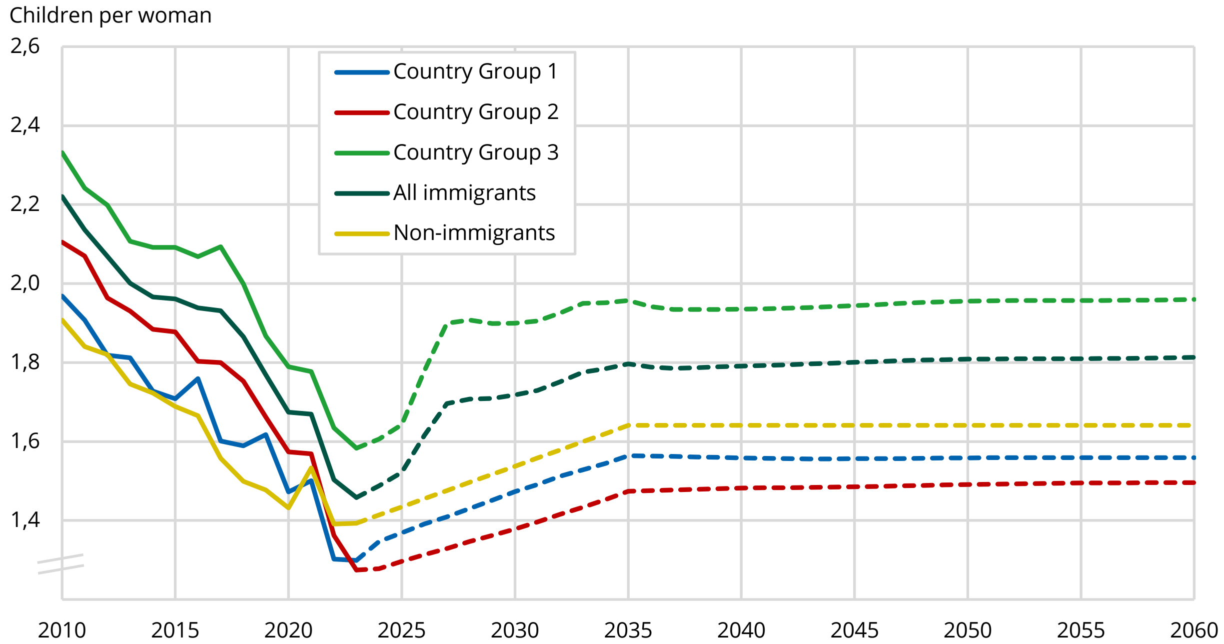
Figure 4.2 Total fertility rate in Norway, registered 1990-2023 and projected 2024-2060 in three alternatives



Source: Statistics Norway

Figure 4.3 shows registered and projected TFR (MMM) for immigrant women from each of the three country groups, non-immigrant women, and all immigrant women. While immigrant fertility is projected to remain higher than non-immigrant fertility, this is driven by the relatively high TFRs for Country Group 3. Immigrant women from Country Groups 2 and 3 are projected to have lower TFRs than the non-immigrant population. Long-term fertility for women with immigrant backgrounds stabilize at around 1.80 children per woman, which compares to 1.64 for non-immigrant women.

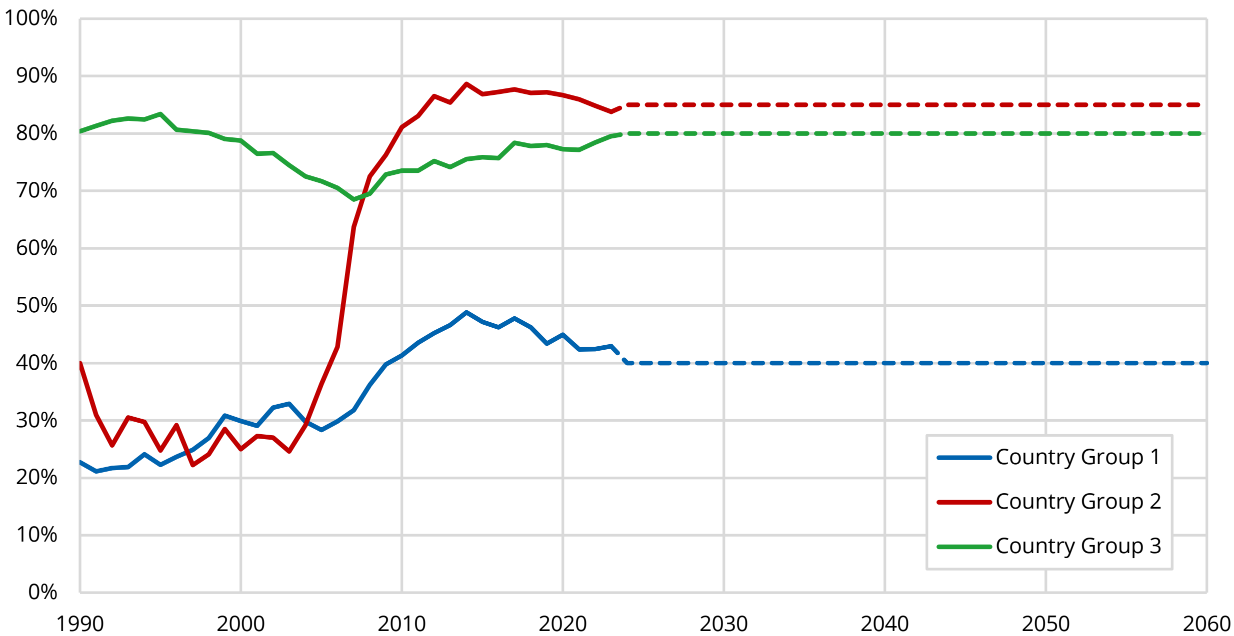
Figure 4.3 Total fertility rate in Norway by country group, registered 2010-2023 and projected 2024-2060, main alternative (MMM)



Source: Statistics Norway

To calculate the number of Norwegian-born children to two immigrant parents, we make assumptions about the proportion of immigrant women who will have children with immigrant men. This is discussed in more detail in the chapter on international migration (Chapter 7). Figure 4.4 visualises the assumptions for the shares used in this year's projections.

Figure 4.4 Share of immigrant women who have children with immigrant men, by country group, registered 1990-2023 and projected 2024-2060



Source: Statistics Norway

4.2. Life expectancy and mortality

Statistics Norway uses the product-ratio variant of a Lee-Carter model (Hyndman et al. 2013), where the trend in mortality for the selected time period, represented by two estimated time series, is extended using an autoregressive integrated moving average (ARIMA) model. The historical period used as a basis for the projections is determined prior to each projection round.

This method produces mortality rates by age and sex up to and including the year 2100. The mortality rates are converted into probabilities before being used in the BEFINN model. The projected mortality rates are also used to calculate life expectancy at birth and the remaining life expectancy at every age up to and including 105 years. Calculations are made for men and women separately, as well as for both sexes combined.

Data

The figures for the number of deaths and the size of the population are taken from Statistics Norway's population statistics. In the current projections, we use input data for the period 2000-2023. We calculate age-specific mortality rates for men, women and both sexes combined for all ages 0-110 and allow for the fact that deaths do not occur linearly throughout the year. Once we have calculated the mortality rates in the input period and adjusted for extreme values (See Box 4.2), the actual modelling of projected rates can begin.

Box 4.2 Mortality rates

Age-specific death rates (0-90 years) for each calendar year for men and women, and for both sexes combined, are calculated using a formula for piecewise constant death intensity (Foss 1998). When calculating age-specific rates, age is defined as age at the end of the calendar year. When the death rates are calculated, they are corrected for extreme values. Extremely low death rates, or cases where there are no deaths in some age groups and/or years, are replaced by the average of the rate for the age group before and after.

There are often large fluctuations from year to year for ages 101-110. Therefore, to estimate projected death rates for these age groups, a logistic model has been used to extrapolate and smooth the estimated death rates for ages 101-110 years. Input in this model is death rates for the age groups 70-100 years in the period 2000-2023. This reduces the noise in the estimates at high ages and provides stable projected death rates for the entire age range. For ages 110-119 years, the probability of death is set at 0.5 for both men and women throughout the period.

Modelling mortality

Initially, we use the product-ratio method (Hyndman et al. 2013). The purpose of this method is to reduce the correlation between the mortality rates for men ($_M$) and women ($_W$). The method can be formally described as follows:

$$p(x,t) = \sqrt{(m_M(x,t) * m_W(x,t))}$$

$$r(x,t) = \sqrt{(m_M(x,t)/m_W(x,t))}$$

where $p(x,t)$ is defined as the square root of the product of the mortality rate of men (m_M) and women (m_W) at age x in year t, and $r(x,t)$ corresponds to the square root of male mortality rate divided by the female mortality rate. So long as $p(x,t)$ and $r(x,t)$ are not completely uncorrelated, the correlation is significantly reduced when applying this method.

A model based on the Lee-Carter method (Lee and Carter 1992, Lee 2000, Li and Lee 2005) is then applied to the observed mortality data in our sample. The method estimates parameters of changes in the mortality level over time and by sex and age. It can be expressed as follows:

$$log\ m(x,t) = a(x) + \sum b_i(x)k_i(t) + u(x,t),$$

where $log\ m(x,t)$ is the logarithm of the mortality rate in year t for age x, $a(x)$ is the general age pattern, $b_i(x)$ is the age-dependent correction in the time index, $k_i(t)$ is the time index and $u(x,t)$ is a stochastic error term that is assumed to be normally distributed.

Given that we have already reworked the mortality rates, $m(x,t)$, for men and women using the product-ratio method, we use a Lee-Carter model in which the mortality rates for men and women are replaced by $p(x,t)$ and $r(x,t)$, respectively. We thereby model mortality for men and women in the same process. The sum of the age-dependent correction in the time index $b_i(x)$ multiplied by the time index $k_i(t)$ can consist of one or more components. Our data prove to be well adapted using the following Lee-Carter model with two components (Keilman and Pham 2005):

$$log\ p(x,t) = a_p(x) + b_{p1}(x)k_{p1}(t) + b_{p2}(x)k_{p2}(t) + u_p(x,t)$$

$$log\ r(x,t) = a_r(x) + b_{r1}(x)k_{r1}(t) + b_{r2}(x)k_{r2}(t) + u_r(x,t)$$

To this point, we have only modelled the observed mortality rates, from 2000 to 2023. To make assumptions about how mortality will develop in the future, we use an ARIMA model (Wei 2006). In this model we use what is termed a 'random walk with drift' (RWD), which means that we take account of a trend in mortality that we expect to continue forward. The formula we use is as follows:

$$k_i(t) = \theta_i + k_i(t-1) + v_i(t),\ i=1,2,$$

where θ_i is the trend (drift), $k_i(t)$ is the time index, and $v_i(t)$ is a stochastic error term that is assumed to be normally distributed.

When we enter the predicted values for $k_1(t)$ and $k_2(t)$ in the Lee-Carter model, together with the estimated values for the age profiles, $a_i(x)$ and $b_i(x)$ (i=1,2), we obtain predicted values for $p(x,t)$ and $r(x,t)$. These are transformed back into the projected mortality rates $m(x,t)$ for men and women, respectively.

Once we have calculated the age-specific mortality rates for the projection period using the models presented above, uncertainty from the RWD model is estimated by simulating 5 000 alternatives by means of bootstrapping. This yields different paths for a possible development in future life expectancy.

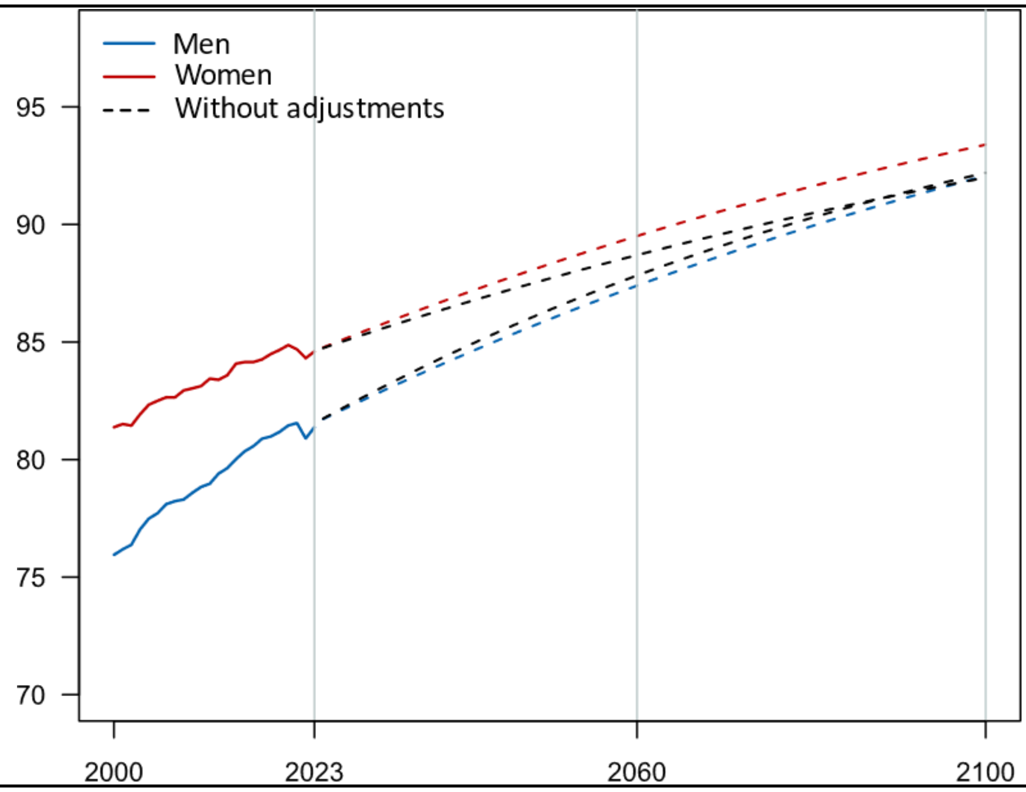
Before the age and sex-specific mortality rates in the four alternatives (described below) can be used in the BEFINN model, the mortality rates are converted into probabilities using the following formula:

$$q(x,t) = 1-(exp(-m(x,t)))$$

Discretionary adjustments

The period used as input is determined prior to each projection round. After assessing the plausibility of the projected mortality rates resulting from the model, we also make other discretionary assessments. While there are certain well-known issues with the estimated mortality rates, such as a slightly poor fit of infant mortality and too large a reduction in young age mortality, we argue that these discrepancies are tolerable from the perspective of a population projection. However, given male mortality has declined more than female mortality since 2000, simple extrapolation leads to higher life expectancies for men than women for several ages in the range 50-80 years. We have therefore made a discretionary adjustment that, throughout the projection period, reduces the mortality rates and increase life expectancy somewhat more than the initial model estimates indicate for women (see Section 6.2). The effect of this adjustment on life expectancy at birth is shown in Figure 4.5.

Figure 4.5 Projected life expectancy at birth for men and women, with and without discretionary adjustment, registered 2000-2023 and projected 2024-2100[1]



[1] Dashed lines represent the medium alternative in each instance.
Source: Statistics Norway

Mortality assumptions

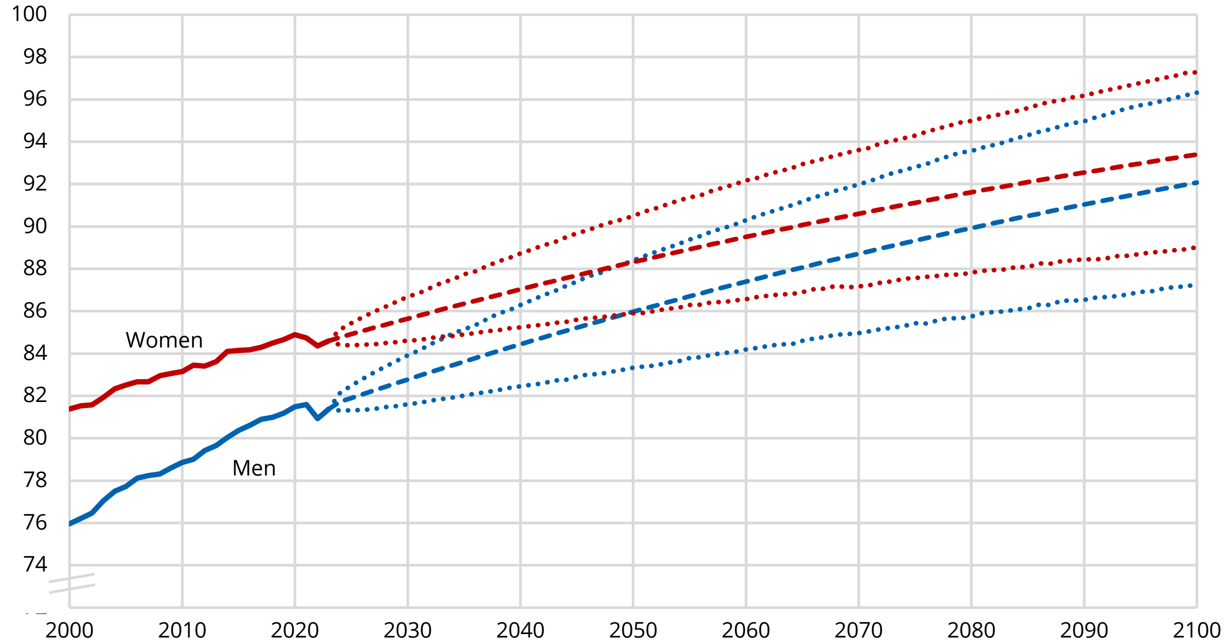
It is the projected probabilities of death that are used as assumptions for mortality in BEFINN. We employ probabilities of death by sex, one-year age group, and calendar year in four alternatives: Medium (M), low (L), high (H), and constant (C) life expectancy.

The estimated (adjusted) projection using the ARIMA model is referred to as the medium alternative, around which we specify an 80 percent prediction interval, in line with international recommend-dations (Savelli and Joslyn 2013). The lower limit in the prediction interval for life expectancy is called the low alternative (low life expectancy), while the upper limit is called the high alternative (high life expectancy). In other words, we consider it 80 percent likely (odds of 4 to 1) that the future life expectancy at birth will be between these limits. In addition, we calculate a constant alternative, where the death rates for the first projected year are kept constant for all subsequent years.

The same mortality level is assumed for immigrants as for the general population, since the disparities on average are below ten percent and decline further for immigrants with longer duration of stay in Norway (Syse et al. 2016, Syse et al. 2018).

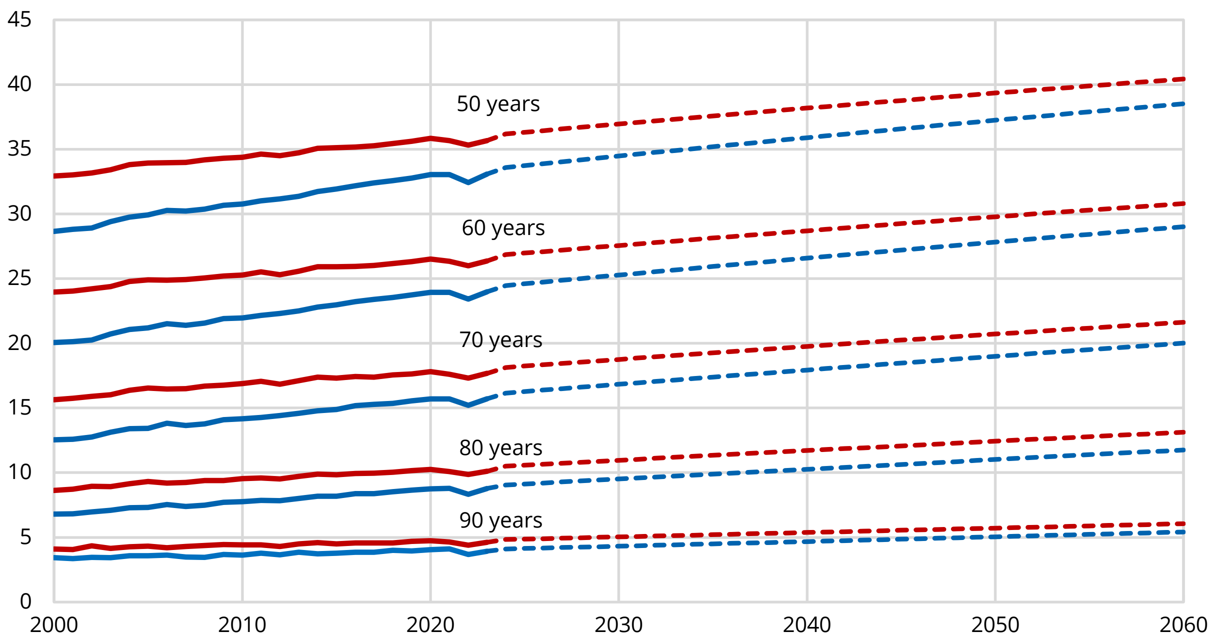
In the medium alternative, male life expectancy at birth is assumed to increase by a further 4.6 years by 2050 – from 81.4 years in 2023 to 86.0 years in 2050. Over the same period, female life expectancy at birth is assumed to increase by around 3.7 years, from 84.6 in 2023 to 88.3 in 2050. In the high alternative for life expectancy, the increase is clearly stronger – 7.0 years for men and 5.9 years for women – while the low alternative assumes a weaker increase of 2.0 years for men and around 1.3 years for women. Registered and projected life expectancy at birth in three alternatives is given in Figure 4.6.

Figure 4.6 Life expectancy at birth for men and women, registered 2000-2023 and projected 2024-2100 in three alternatives[1]



[1] Dotted lines refer to high and low life expectancy alternatives, dashed lines to medium alternatives.
Source: Statistics Norway

Figure 4.7 Remaining life expectancy at ages 50, 60, 70, 80, and 90 for men (blue) and women (red), registered 2000-2023 and projected 2024-2060, medium alternative



Source: Statistics Norway

One of the main reasons for the projected increase in life expectancy at birth is the expected increase in remaining life expectancy in older age groups, as shown in Figure 4.7. For 60-year-olds, remaining life expectancy in 2023 was just over 24 years for men and 26 years for women. In the medium alternative, 60-year-olds in 2050 are assumed to have a remaining life expectancy of 28 years for men and 30 years women. As we move up the age distribution the relative increase in life expectancy is lower. For 90-year-olds in 2023, remaining life expectancy for men was 3.9 years, while for women it was 4.6 years. By 2050, we assume an increase to 5.0 years and 5.7 years, respectively.

To summarise, we assume life expectancy to increase in the future. Consequently, people in the oldest age groups will constitute an increasing share of the population in the years to come. The mortality gap between men and women is expected to narrow as we move further into the future.

4.3. Immigration and emigration

In the population projections, immigrations and emigrations are calculated separately. Net migration constitutes the difference between the two. Whereas future immigration is estimated using a model, future emigration probabilities are calculated based on observed emigration patterns during the period 2012-2019.[4]

For both immigration and emigration, the world outside Norway is divided into three country groups of origin (see also Box 4.3 and Appendix A):

1. Western Europe, the US, Canada, Australia and New Zealand
2. Eastern EU member countries
3. The rest of the world

Box 4.3 The country groups

We have divided the countries of the world into three groups. Even though there are pronounced differences within the country groups, there are also certain similarities.

Country Group 1 comprises all the Western European countries, i.e., countries that were part of the 'old' EU (pre-2004) and/or the EEA and EFTA, as well as the US, Canada, Australia, and New Zealand. On average, individuals from these countries display relatively similar demographic behaviour with regards to fertility and emigration. Moreover, few or no restrictions apply in terms of opportunities for living and working in Norway.

Country Group 2 comprises the eleven new EU countries in Eastern Europe (EU members in 2004 or later): Estonia, Latvia, Lithuania, Poland, Czechia, Slovakia, Hungary, Slovenia, Croatia, Bulgaria, and Romania. Migration from these countries was a major contributor to the immigration peak in Norway from 2007 to 2016. Moreover, of all the EU countries, it is these 11 countries where the income differences are greatest relative to Norway, while the expected demographic development in these countries also differs from other parts of the EU (e.g., with especially low fertility and projected population decline). As with all EU citizens, persons from this country group have the right to live, work, and study in Norway.

Country Group 3 comprises the rest of the world, i.e., the rest of Eastern Europe, Africa, Asia (including Türkiye), South and Central America and Oceania (excluding Australia and New Zealand). Nationals from these countries must apply for a permit to live and work in Norway. This group is extremely heterogeneous, and we have primarily grouped these countries for the sake of simplicity.

Immigrants are grouped according to their own country group of origin while Norwegian-born children to two immigrant parents are grouped according to their mothers' country of origin, see Box 4.4.

[4] We did not use registered data for 2020 and 2021 in the calculation of future emigration probabilities due to the strict global travel restrictions that severely restricted opportunities for cross-border travel and relocation in these years. The years 2022 and 2023 were also affected by catchup from the delayed moves in the previous years.

Box 4.4 Commonly used terminology

In the population projections – and in Statistics Norway's other statistics – an *immigrant* is defined as a person born abroad with two foreign-born parents and four foreign-born grandparents and registered as resident in Norway.

Immigration is defined as the number of migrations to Norway over a single-year period, irrespective of the immigrants' country of birth or citizenship. For example, over the last decade, immigration to Norway has included an average of 7 000 Norwegian citizens per year, most of whom are born in Norway and are thus not considered immigrants.

Emigration is defined as the number of migrations out of Norway during a period, irrespective of the country of birth or citizenship.

Net migration corresponds to the difference between the number of immigrations and emigrations during a single year.

In the population projections, we project the population from the same date one year to the next. This means that people who move in and out of the country (or vice versa) within a year are not included in the population projections figures for immigration and emigration. As such, the immigration and emigration figures from the population projections are somewhat lower than the corresponding figures from Statistics Norway's population statistics. Net migration figures are, however, comparable.

Norwegian-born with two immigrant parents are defined as persons born in Norway to two parents born abroad, and who also have four grandparents who were born abroad.

When we divide immigrants and the Norwegian-born persons with two immigrant parents according to the three country groups, we use 'country background' and not, for example, citizenship or which country they emigrated to Norway from. *Country background* is constructed based on information on country of birth. For immigrants, this is (with a few exceptions) their own country of birth. For Norwegian-born to two immigrant parents, the mother's country of birth is used.

Data

Data on Norwegian immigration and emigration are derived from Statistics Norway's population statistics. If someone moves both to and from Norway (or vice versa) during the same calendar year, this is neither registered as an immigration nor an emigration in this context, since the population projections are based on a change taking place from the turn of one year to the turn of the next. This does not affect the figures for net migration, but both the immigration and emigration figures will be a little lower than those that are published in the general statistics. This applies particularly to persons from EU countries (i.e., Country Groups 1 and 2), who can move freely between the EU/EFTA/EEA countries.

For the immigration projections, data are needed from other sources (see Chapter 7). In short, the population of the three country groups in broad age groups (0-14, 15-39 and 40+ years) is used as the denominators in the emigration rates from these groups. The figures were obtained from the United Nations (2022) World Population Prospects. The purchasing power-adjusted GDP per capita in Norway and in the three country groups were obtained from the World Bank. The unemployment rate in Norway is based on the ILO definition and is taken from the labour force survey conducted by Statistics Norway. Similar data for Country Groups 1 and 2 may be found in databases from the OECD and Eurostat. For Country Group 3 (the rest of the world), there are no figures for the unemployment rate that give a satisfactory picture of the labour market situation. When the model is estimated for this group, this variable is therefore not included. Lastly, we have calculated a measure of the network effect using the number of immigrants from each country group who are resident in Norway. These figures are taken from Statistics Norway's population statistics. Prior analysis suggests that the network effect only bears relevance to immigrants from Country Group 3 and therefore network effects are only included for this group. For the emigration rate, GDP per capita, and the unemployment rate, we aggregate individual country data to averages for each group using population shares as weights.

Econometric models for three country groups and three age groups

Our modelling approach follows Cappelen and Skjerpen (2014) and the references therein. In Section 7.3 we provide some theoretical underpinnings for the econometric models employed for forecasting, cf. Equations (1)-(5) and the interpretation of them in our empirical context.

We use a disaggregated approach when it comes to the age composition of immigrants. That is, we split the population in each country group into three different age groups. Age group 1 consists of persons aged 0 to 14 years, age group 2 consists of those aged 15 to 39 years, and age group 3 consists of those aged 40 or older. Thus, the emigration rate, which is the immigration rate to Norway, is disaggregated into three different variables. This is the same age-disaggregation as employed by Skjerpen and Tønnessen (2021). We do not have data for incomes, unemployment, and migration costs that are disaggregated by age, so we continue to use aggregated series for these variables (see Eq. (6) in Section 7.3). The primary motivation behind age disaggregation relates to the fact that most migrants tend to be young, typically belonging to age group 2. The United Nations (2022) also projects strong population ageing in all three sending country groups, which should have important implications for future trends in immigration to Norway. The oldest age group, which has the lowest risk of migration, is already the largest in Country Groups 1 and 2 and it is soon set to become the largest in Country Group 3.

It is reasonable to assume that the migration propensities of the youngest age group (0-14) are linked to the propensities of the other two age groups because most child migrants arrive with their parents. Since we use annual data, we encounter a simultaneity issue when estimating the immigration rate of the youngest age group, given its dependence on the migration rate for the other two age groups. This is handled in the modelling approach.

Excluding dummies, the most common variables used in the models are:

M_{ijt} The number of individuals in age group *i* that emigrate to Norway from country group *j* in year *t*.
i=0-14,15-39,40+; *j*=1,2,3.

P_{ijt} The mean population (in 1000s) in age group *i* in country group *j* in year *t*.
i=0-14, 15-39, 40+; *j*=1,2,3.

RY_{jt} Nominal GDP in Norway per capita (in PPPs) in year *t* divided by nominal GDP per capita in country group *j* in year *t*.

U_{kt} The unemployment rate in year *t* measured in percentage terms for country group *k*.
k=NOR,1,2.

$STOCK_t$ The stock of immigrants living in Norway at the start of year *t*. This variable is used only for Country Group 3.

In Section 7.3 we present the models used for forecasting immigration from the three country groups. Altogether there are nine equations, one for each age group within each country group. All the equations are specified in logarithms. The left-hand side variable is the log of the emigration rate for a specific age group in a specific country group in a given year, where the emigration rate is given by the emigration to Norway divided by the mean population (measured in 1 000s) of the age group in the country group. The equations for Country Group 1 are in (7), the equations for Country Group 2 are in (8), and the equations for Country Group 3 are in (9). The equations for Country Groups 1 and 2 are estimated using instrumental variables (IV) or via ordinary least squares (OLS), whereas the parameters for Country Group 3 are either calibrated or estimated by full information maximum likelihood (FIML). A detailed discussion of the results obtained for each of the country groups is provided in Section 7.3.

Forecasts of the variables

Once the parameters have been estimated (or calibrated) for each of the nine equations, they are used to calculate how immigration to Norway will develop going forward. To be able to do this, we need forecasts of how the economic and demographic variables will also develop over the projection period (the explanatory or forcing variables).

The future development of the population in the three country groups is taken from the most recent United Nations population projections (United Nations 2022). In our medium alternative, we use the United Nations medium variant. In our high and low alternatives, we use United Nations high-fertility and low-fertility variants, respectively.

For Country Group 1 (CG1), the registered and projected age distribution undergoes considerable change. While the number of children in CG1 has been approximately constant at between 130-140 million from the early 1980s, the number of people aged 40+ years has been increasing and is expected to reach 500 million during the 2040s. Meanwhile, the most mobile age group, 15-39, is expected to gradually decline in size, from around 260 million people today, to around 240 million by 2050 and 220 million by 2100. There is marked uncertainty as to whether the total in CG1 population will remain broadly stable, decline, or increase. The United Nations medium variant suggests future population growth will be limited, and far lower than has been observed over recent decades.

The age profile of Country Group 2 (CG2) is also expected to change. The number of people in the most mobile age group (15-39) started to decline in the period after which most of these countries became EU-members. This is to some extent a result of the fact that many people in this age group emigrated to Northern and Western European countries, including Norway. The decline in the size of the youngest age group took place earlier, when fertility levels dropped sharply in the period following the collapse of the Soviet Union. It is expected that the population aged 0-14 and 15-39 will continue to decline from this point on. For the oldest age group, limited growth is expected into the 2030s, before it too enters a decline. The total population of CG2 is currently around 105 million and is projected to fall below 70 million by 2100 according to the United Nations medium variant. If the aggregate emigration rate to Norway from CG2 were to remain constant, population decline alone would lead to a strong reduction in annual emigration to Norway. It should also be noted that even in the United Nation’s (2022) high-fertility variant, the population of CG2 does not return to its current size throughout the projection horizon.

Country Group 3 (CG3) has by far the largest population among the three country groups. According to the United Nations medium variant, the population in this country group will peak in the 2080s at around 9.5 billion. In the low-fertility variant it will reach a maximum of around 8 billion sometime during the 2050s, while in the high-fertility variant the trend in population growth over the last 30 years or so will simply continue (reaching 13.5 billion by 2100). Still, if we assume the medium variant is closer to the true future development, virtually all of population growth in CG3 is expected to take place among the oldest age groups, while the population aged 0-14 is expected to have effectively peaked already. CG3 is no different in expecting significant population ageing in the coming decades.

The initial estimates of the future number of immigrants residing in Norway (which are used to identify the network effect) are based on figures from the population projections made in 2022. Once the initial number of future immigrations from CG3 has been predicted via the migration model, the updated figures on future immigrations are fed into the population projection model (BEFINN). The projection model produces new estimates for the stock of immigrants from each country group, with the figures for CG3 used to re-estimate immigration from CG3 again. Such iteration rounds are repeated several times until convergence is obtained. As mentioned earlier, a network effect is only present for CG3.

Forecasts for the unemployment rate in Norway are taken from Statistics Norway's macroeconomic projections (Statistics Norway 2024). In the long term, the unemployment rate has been levelled off to a historically 'normal' level around the average of the last three decades (4 percent). Since 2010, the unemployment rate in CG2 has significantly reduced. We assume that it will stay at a low level (4.5 percent) in the long run. For Country Group 1, the unemployment rate has also remained low over this period and again, in the long term, it is expected to stay at a relatively low level (5.5 percent). The changing demographic structure in CG1 and CG2 is one reason why we think this is a reasonable long-run assumption. The unemployment rates are assumed to be the same in all three scenarios.

Three alternative paths have been made for future income development (low, medium, and high alternatives). The high alternative assumes the greatest income differences between Norway and the rest of the world. In this case, the relative income levels are extrapolated from levels similar to recent years, albeit lower than was observed in 2022 and 2023. The Norwegian economy is highly affected by changes in the prices of crude oil and natural gas and has enjoyed dramatic terms of trade improvements, which greatly affected relative incomes in 2022 and 2023. We have assumed that oil and gas prices return to more normal levels so that the relative increase in Norwegian incomes is short lived. The medium alternative assumes that non-oil GDP per capita in Norway follows that of CG1, while the gradual phasing out of oil and natural gas exploration in Norway takes place according to the most recent figures available and thus contributes to a reduction in Norwegian GDP per capita in relative terms. In the low alternative there is absolute convergence in relative incomes between Norway and CG1 from 2050, while a trend towards convergence persists through to 2100 for CG2 and CG3, although full convergence does not occur. A more thorough discussion of historical and projected relative income per capita ratios for each country group in the three alternatives is provided in Section 7.3.

Immigration forecasts for the three country groups

The estimated equations corresponding to (7)-(9) are utilised for dynamic projections. First, the unknown parameters are replaced by their estimates (or calibrated values) and the residuals are set to zero. Second, the log of the immigration rate of the age groups is forecasted and the rates are then multiplied with corresponding population forecasts from the United Nations. For CG3, the forecasts are based on the iterative procedure mentioned above. Note that we have time series for the exogenous variables on the right-hand side for the period 2024-2100. Values for the lagged right-hand side variables are obtained recursively ('dynamic forecasts').

Projected immigration

Based on these different demographic and economic estimates, the immigration model yields three different paths (low, medium, and high alternatives) for immigration from each of the three country groups. The estimated standard error of the forecasts is used to allow for model uncertainty in the calculations.[5] This is done by adding the standard error of the prediction error to the forecast for immigration in the high alternative and correspondingly deducting the standard error from the low alternative.

Due to the war in Ukraine, and the subsequent refugee crisis, we have made *ad hoc* adjustments to the low, medium, and high immigration alternatives for Country Group 3. More specifically, the

[5] When calculating the standard error of the forecast error at a specific horizon, we only pay attention to the errors in the econometric models and neglect the contribution from estimation uncertainty.

adjustment in the medium alternative involves the inclusion of an additional 20 000 gross immigrations in 2024, followed by an additional 10 000 in 2025 (30 000 in total). The low alternative comprises an additional 5 000 gross immigrations in 2024, a figure which is based on the approximate number of collective protection applications received thus far, while the high alternative includes an additional 30 000 gross immigrations in 2024, followed by 25 000 in 2025, and 10 000 in 2026 (65 000 in total). We assume a return to relative normality in 2025 in the low alternative, 2026 in the medium alternative, and 2027 in the high alternative. The *ad hoc* adjustments to the low, medium, and high alternatives implicitly make assumptions about both the magnitude and duration of refugee flows from Ukraine. Clearly, these assumptions are very uncertain. We discuss the formation of these *ad hoc* adjustments in more detail in Section 7.1.

Every year, several thousand people with a Norwegian background return to live in Norway. This group also includes persons born in Norway to two foreign-born parents. Assumptions about the future immigration of this group are based on registered immigration patterns over the past decade, but also reflect an assumed increase in the numbers over time. The slight increase in the trend over time is motivated by a recognition that Norway will have a growing population of Norwegian-born persons with two immigrant parents. This population has a higher likelihood of having ties to countries elsewhere, which may facilitate higher propensities for international migration. More generally, as emigrations occur, the stock of people with a Norwegian background (who could potentially return) will also increase. In our medium assumption, we expect the immigration of 'non-immigrants' to increase from around 5 700 today, to 6 100 in 2050 and 7 000 in 2100. The high assumption is 2 000 higher than the medium assumption throughout the projection period, while the low assumption is 2 000 lower.

The number of immigrations from the three country groups (projected in three alternatives), as well as the number of immigrations by persons with a Norwegian background, are entered into the national population projection model (BEFINN).

Emigration

Emigration is calculated using emigration probabilities derived from observed data for the period 2012-2019, i.e., excluding the peak COVID-19 years. The propensity to emigrate is significantly higher for immigrants than for Norwegian-born with two immigrant parents, though emigration rates among immigrants do decline as their duration of stay in Norway increases. Persons without an immigrant background have the lowest propensity to emigrate. For immigrants from the three country groups, emigration propensities are typically highest for those from Country Group 1 and lowest for those from Country Group 3.

In the population projections, separate emigration probabilities are used for immigrants, Norwegian-born with two immigrant parents, and the rest of the population. The probabilities are calculated by sex, one-year age group (0–69 years), country group, and duration of stay (for immigrants), with a few exceptions:

- For persons under the age of 15, the same probability of emigration is used for boys and girls
- For persons aged 55–69, the probabilities are calculated for five-year age groups for each sex

Five duration-of-stay groups are used:

- 0 years
- 1 year
- 2–4 years
- 5–9 years
- 10+ years

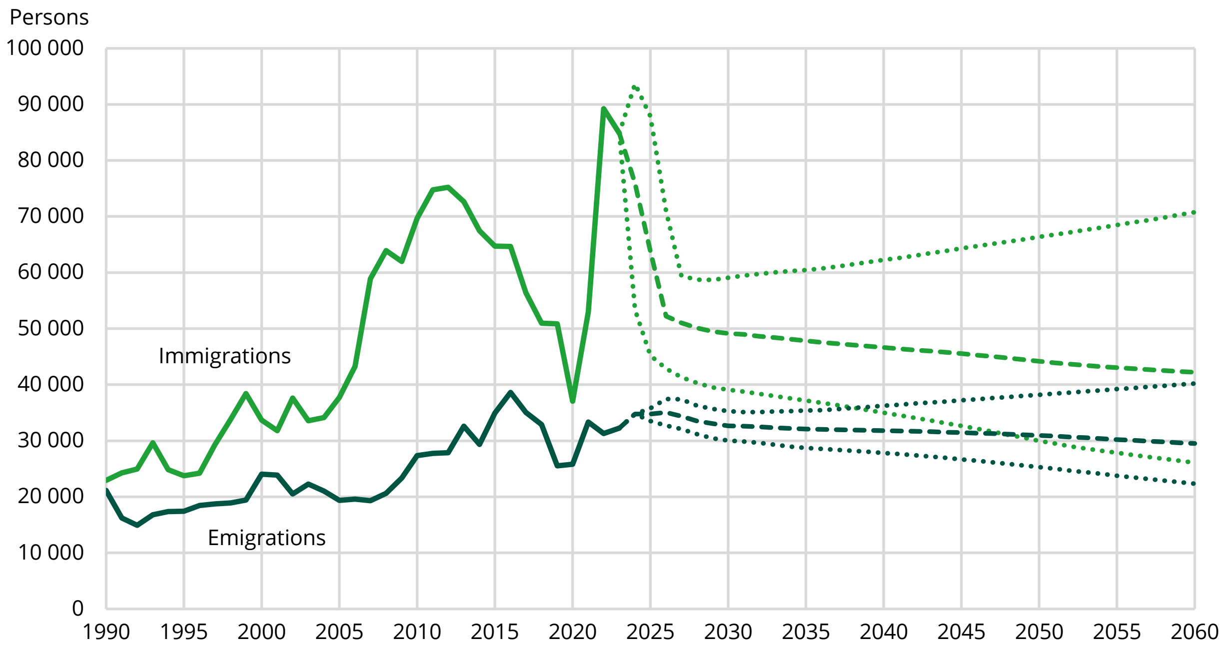
For immigrants from Country Group 2 with the longest duration of stay, we have too few observations to produce reliable emigration probabilities. An average of the emigration probabilities for persons with the longest duration of stay in Country Groups 1 and 3 is used instead. The population projections do not assume any immigration or emigration among persons who are aged 70 or above.

Since high immigration one year will entail higher emigration in the ensuing years, the estimates of the number of emigrations are largely dependent on the figures for immigration. Separate high and low assumption alternatives for emigration are thus not currently produced. We therefore produce only one (medium) assumption for emigration.

International migration assumptions

Figure 4.8 presents the projected total gross immigration and emigration in three alternatives. For immigration, we assume an initial decline in the main alternative to 76 000 in 2024 (low 53 000, high 94 000) and 64 000 in 2025 (low 45 000, high 88 000). While lower than the observed levels in 2022 and 2023, these values are high from a historical perspective and include the Ukraine-related *ad hoc* adjustments mentioned above. Thereafter, the yearly immigration to Norway in the main alternative is assumed to gradually reduce to around 50 000 in 2030 (low 40 000, high 60 000), 45 000 in 2050 (low 30 000, high 65 000), and 40 000 in 2100 (low 15 000, high 90 000).

Figure 4.8 Immigrations and emigrations, registered 1990-2023 and projected 2024-2060 in three alternatives[1]



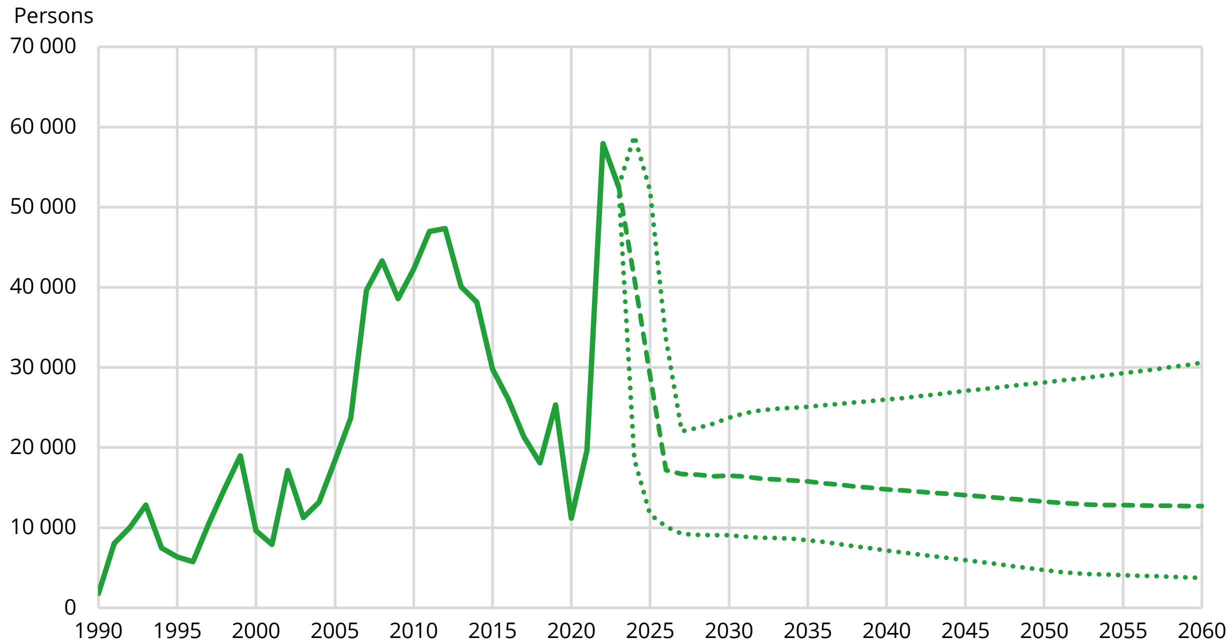
[1] Excludes persons who have both immigrated and emigrated during the same year. The three alternatives are main (MMM), high immigration (MMH), and low immigration (MML).
Source: Statistics Norway

The main alternative projects emigration to slightly increase in the short term, from 32 000 today to around 35 000 in 2026. This short-term increase is driven by the high numbers of recent immigrant arrivals. Following this, we assume emigration to decline year-on-year. The main alternative projects approximately 30 000 emigrations to occur in 2050. We assume a more pronounced decline in emigration in the low immigration alternative, at around 25 000 in 2050, and an increase in emigrations in the high immigration alternative, at almost 40 000 in 2050.

Net migration

Figure 4.9 shows the projected net migration in the main alternative, as well as in the low and high immigration alternatives. Net migration remains positive throughout the projection period in all three alternatives, although the magnitudes vary considerably. Net migration in the main alternative is 41 000 in 2024 and 29 000 in 2025, after which it broadly stabilises at around 13 000 per year from 2050 onwards.

Figure 4.9 Net migration, registered 1990-2023 and projected 2024-2060 in three alternatives[1]



[1] The three alternatives are main (MMM), high immigration (MMH), and low immigration (MML).
Source: Statistics Norway

Distributions by age, sex, duration of stay, and immigrant background

The projections for immigration and emigration are also used to estimate the future number of immigrants and Norwegian-born to two immigrant parents. This is done in the national population projection model, BEFINN. To estimate the future number of Norwegian-born children with two immigrant parents we need an additional assumption describing the proportion of women who have children to immigrant men. We project fixed rates based on observed trends for each of the country groups (see Figure 4.4).

In BEFINN, the assumed number of immigrations from each of the three country groups is distributed by sex, one-year age groups (0–69 years), and one-year duration of stay groups (0–30 years). This distribution is based on empirical trends of immigration over the last ten years. People with a Norwegian background who move back to Norway are distributed by sex, one-year age groups (0–69 years), and whether they are Norwegian-born to two immigrant parents or belong to the rest of the population (i.e., without an immigrant background). If they are Norwegian-born to two immigrant parents, they are distributed based on their mother's country group of origin.

5. Fertility – Assumptions and results

Ane M. Tømmerås

Assumptions about fertility are necessary to project the number of children born, the total population, as well as the age structure of the population. In our projection model (BEFINN), we use the total fertility rate (TFR, see explanation in Box 5.1) to make these assumptions. Following an (almost) continuous decline since 2009, fertility levels in Norway reached an historic low in 2023, at 1.4 children per woman. For reasons that are discussed below, the main alternative in this year's population projections assumes that 2024 will be the start of a phase of increasing fertility. From 2035, the main alternative assumes 1.66 children per woman, while the long-run low fertility alternative is set to 1.21 children per woman and the long-run high fertility alternative is set to around 1.91 children per woman.

Box 5.1 Age-specific fertility rates (ASFRs), total fertility rate (TFR), and cohort fertility

ASFRs are calculated by dividing the number of births to women of a given age by the mid-year population of women of the same age. The age-specific mid-year population is the average number of women of a given age residing in the country in a given calendar year. Women are divided into one-year age groups from 15 to 49 years. The projections also separate women by country background and duration of stay in Norway.

The formula for age-specific fertility rates can be written as follows:

ASFR(x,t) = f(x,t)/k(x,t),

where f(x,t) is the number of live births to women age x in year t, and k(x,t) is the mid-year population of women age x in year t.

The total fertility rate (TFR) is the sum of the age-specific fertility rates for women aged 15–49 years in a given period, normally a calendar year. TFR can be interpreted as the average number of children each woman will give birth to, provided that the period-specific fertility pattern in the calendar year persists and that no deaths occur before age 50. TFR is often also called period fertility, as it reflects the situation in a specific year or period. In reality, the fertility pattern is variable over time. If women simply postpone childbearing, we will obtain depressed period fertility even though the number of children that women have over their life course remains stable.

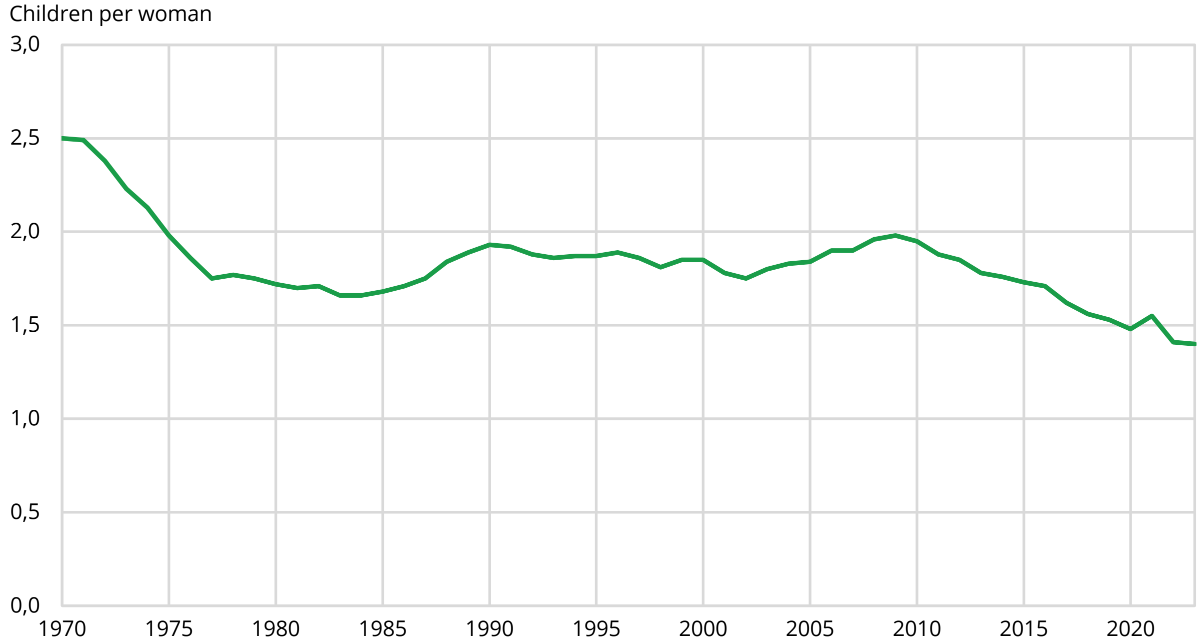
In contrast to this, cohort fertility reflects the average number of births by all women born in the same calendar year. Cohort fertility is usually calculated when women born in the same year have finished their fertile period, often defined at age 45 years, in which case it is termed completed cohort fertility. With data up to 2024, we can calculate completed cohort fertility for women born prior to 1979. Although some women do have children after age 45, the relatively small numbers have only a minor impact on the measurement. Cohort fertility is less variable over time than period fertility as births can be postponed and recovered without major consequences for the final number of children.

A primary aim of this chapter is to provide a detailed overview of how the fertility assumptions for this year's projections were formed. Currently, Statistics Norway does not use a formal statistical model for fertility (Gleditsch et al. 2021). Instead, we consider observed trends in the TFR over recent years, changes in age at first and higher order births, shifts in cohort fertility, as well as differences between immigrant and non-immigrant women in their fertility outcomes. We examine these trends for Norway as well as changing patterns in other European countries, especially the Nordic countries. After detailing the patterns and trends that inform our fertility assumptions, the latter half of the chapter provides a discussion of the consequences of these assumptions for future fertility in Norway.

5.1. Fertility development in Norway

Prior to 2009, the last period with a persistent decline in TFR was the 1970s (Figure 5.1). From the early 1980s, the TFR started to increase and ranged between 1.7 and 2.0 for the period 1990-2009. Indeed, in 2009, the TFR in Norway was among the highest in Europe, and higher nationally than it had been at any time since 1975. Since then, an (almost) persistent decline in the TFR has been observed. The decline in period fertility reflects two dynamics. First, women are postponing having their first child (a tempo effect) and, second, fewer women are having three or more children (a quantum effect) (Hellstrand et al. 2021). While there remains uncertainty over the extent to which the postponed first (and second) births may be 'recovered', we are more confident that the downward trend in third and higher order births will continue. By 2020, TFR had fallen below 1.5 for the first time. After a temporary recovery in 2021 to 1.55, directly linked to the first phase of the COVID-19 pandemic (Lappegård et al. 2023), it fell to 1.41 in 2022 and approximately stabilised at 1.40 in 2023 (or 1.41 if we exclude Ukrainian women from the calculation).

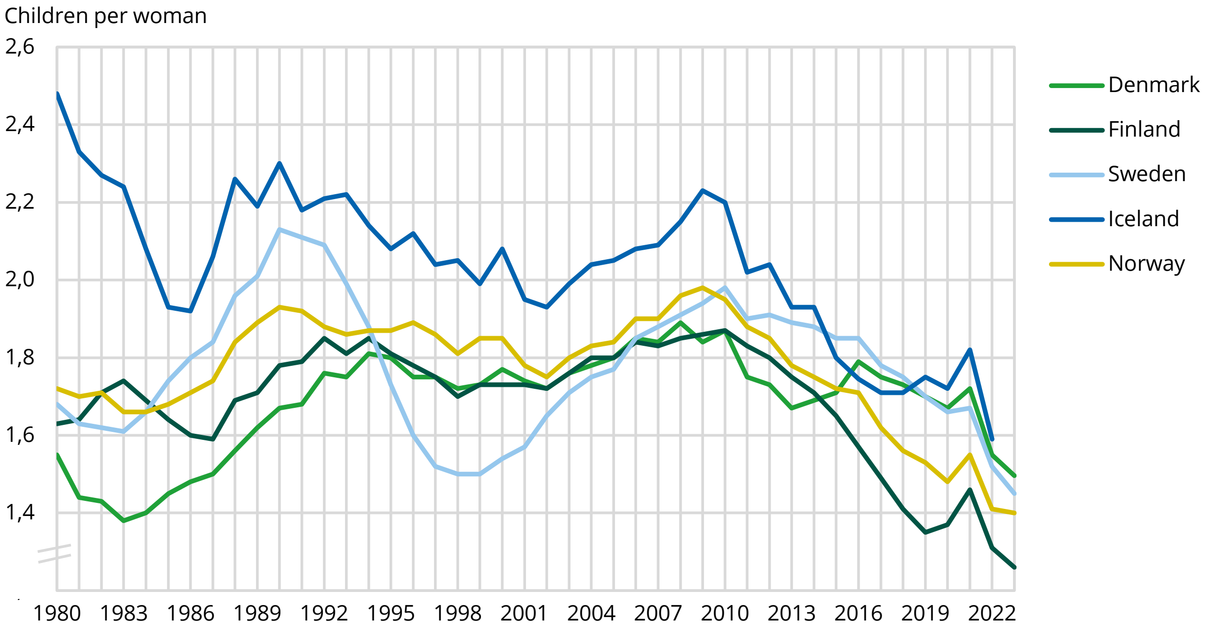
Figure 5.1 Total fertility rate, 1970-2023



Source: Statistics Norway

As Figure 5.2 illustrates, all Nordic countries have witnessed declining fertility over the past decade. By 2023, TFR in Finland had fallen to 1.26, while the TFR in Denmark and Sweden had declined to 1.50 and 1.45, respectively. The most recent published value for Iceland revealed a decline to just under 1.6 children per woman by 2022.

Figure 5.2 Total fertility rate in the Nordic countries, 1980-2023

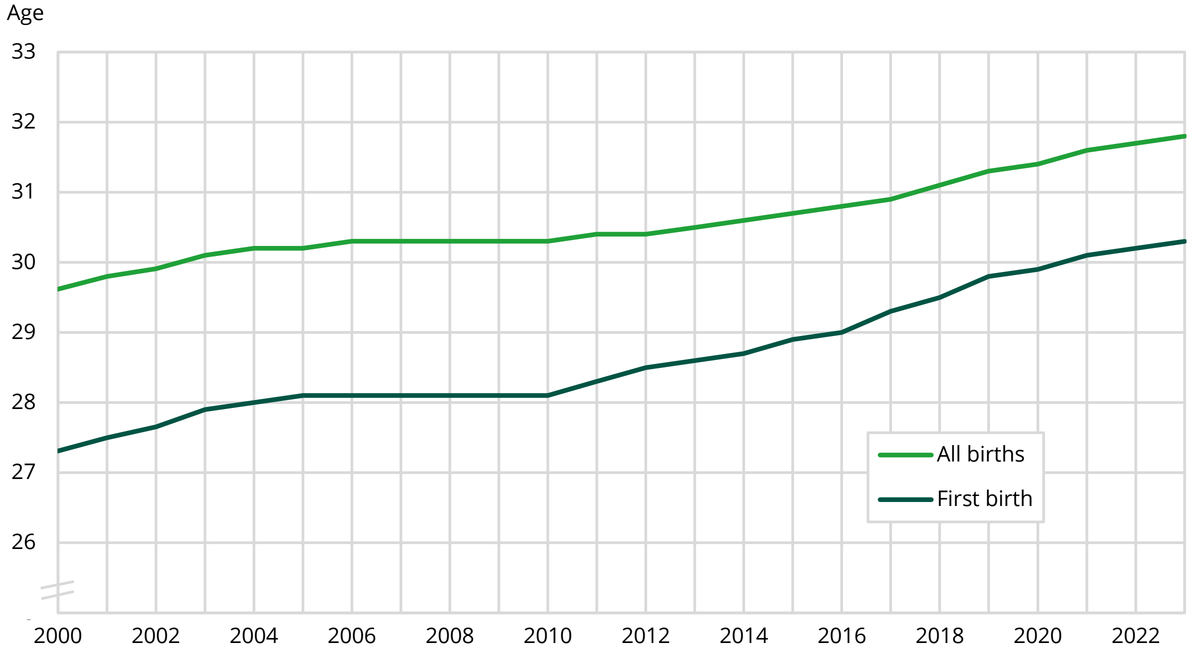


Source: Statistics Norway and the national statistical agency for each Nordic country

The impact of maternal age on fertility

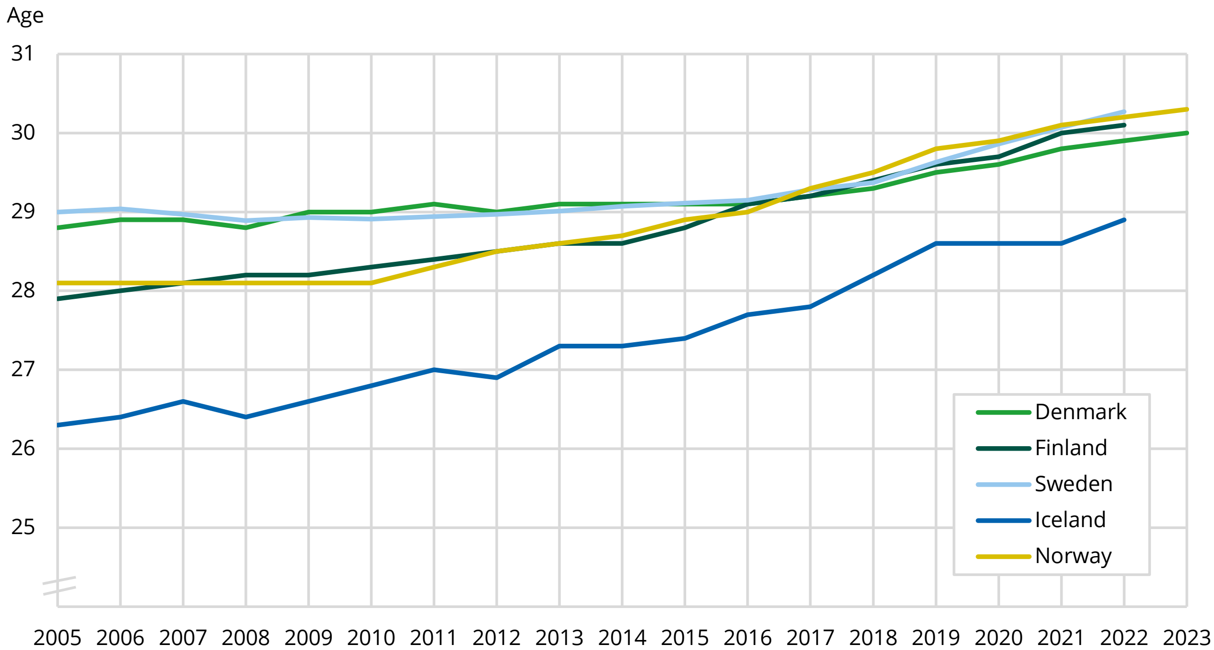
As outlined in Box 5.1, TFR is a summary measure of age-specific period fertility. Thus, TFR is influenced by the ratio of the number of children born to women in the different fertile age groups (between 15-49 years) and the number of women in these age groups. Because TFR summarizes age-specific period fertility rates, it is sensitive to changes in birth timing. Observing a fall in TFR alongside an increase in the population of women in fertile ages could indicate a postponement of childbearing. Moreover, in periods during which the TFR increases, the average maternal age at birth tends to remain stable or increase only slowly, whereas at times when the TFR declines, the average maternal age at birth tends to increase at a more rapid pace, indicating a postponement of births. It is noteworthy that average maternal age at birth remained constant throughout much of the 2000s, at around 28 years for first births and 30 years for all births (Figure 5.3). This was a period in which TFR steadily increased. Since 2010, mothers' average age at first birth has increased from 28.1 years to 30.3 years by 2023. The average maternal age for all births has increased from 30.3 years to 31.8 years over the same period. The increase in average age has been greater for first births (2.2 years) than for all births (1.5 years) over this period, which follows what we would expect in the context of postponed fertility. All Nordic countries have witnessed an increase in the mean age at first birth (Figure 5.4). Mean age at first birth in Sweden and Denmark was around one year higher than in Norway and Finland in 2005, since then there has been a convergence between the countries over time. Iceland has had a considerably lower average age at first birth than the other countries, but this gap has also been closing over time.

Figure 5.3 Mean age of women at first birth and all births, 2000-2023



Source: Statistics Norway

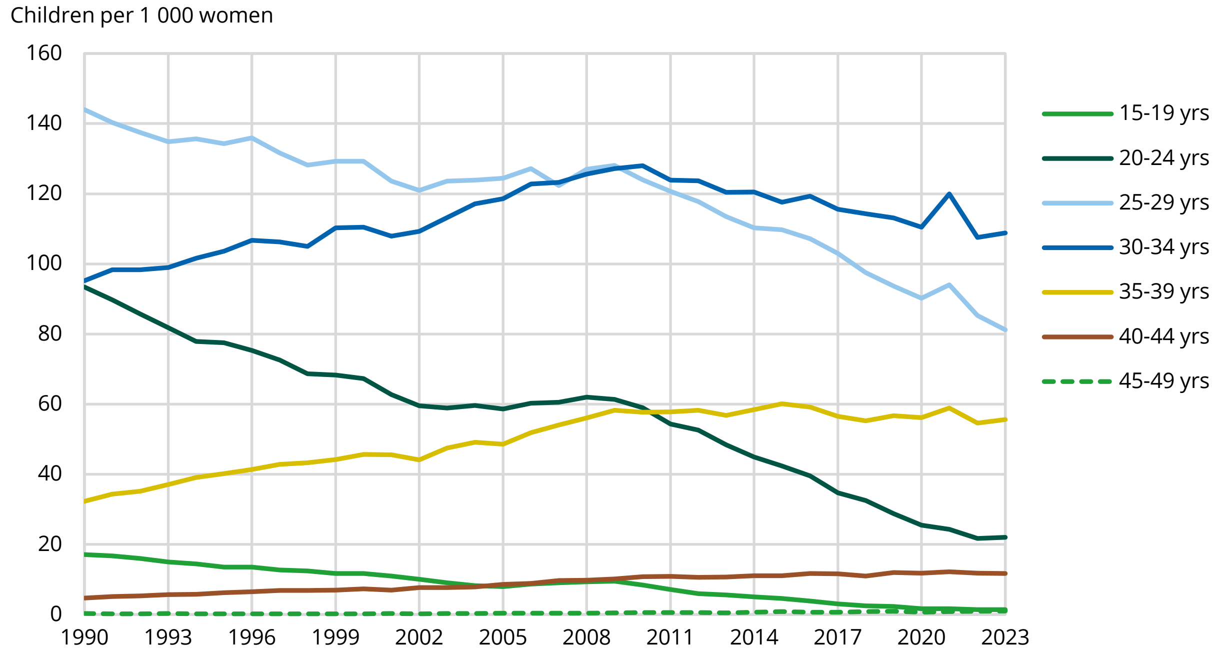
Figure 5.4 Mean age of women at first birth in the Nordic countries, 2005-2023



Source: Statistics Norway and the national statistical agency for each Nordic country

Age-specific fertility rates (ASFRs, see Box 5.1) provide a more detailed understanding of the change in the timing of births over recent years. This measure indicates how many children are born per 1 000 women in a given age group. As can be seen in Figure 5.5, fertility in Norway has generally declined among women aged 15-29 while having generally increased among women in older age groups. These changing trends show that there has been a shift in the age groups that contribute most to fertility in Norway. Until 2009, women aged 25-29 had the highest ASFRs. Since 2009, women aged 30-34 have contributed most. Accompanying this has been a clear decrease in the contribution of women aged 20-24 years, with women aged 35-39 years having had higher birth rates for the last decade. Indeed, the ASFRs of women aged 20-24 are now closer to those of women aged 40-44, with the latter having increased steadily over the past decades, but by no means compensating the strong decline in the younger age groups. Fertility rates among women aged 45-49 remain very low.

Figure 5.5 Children per 1 000 women, by age group, 1990-2023



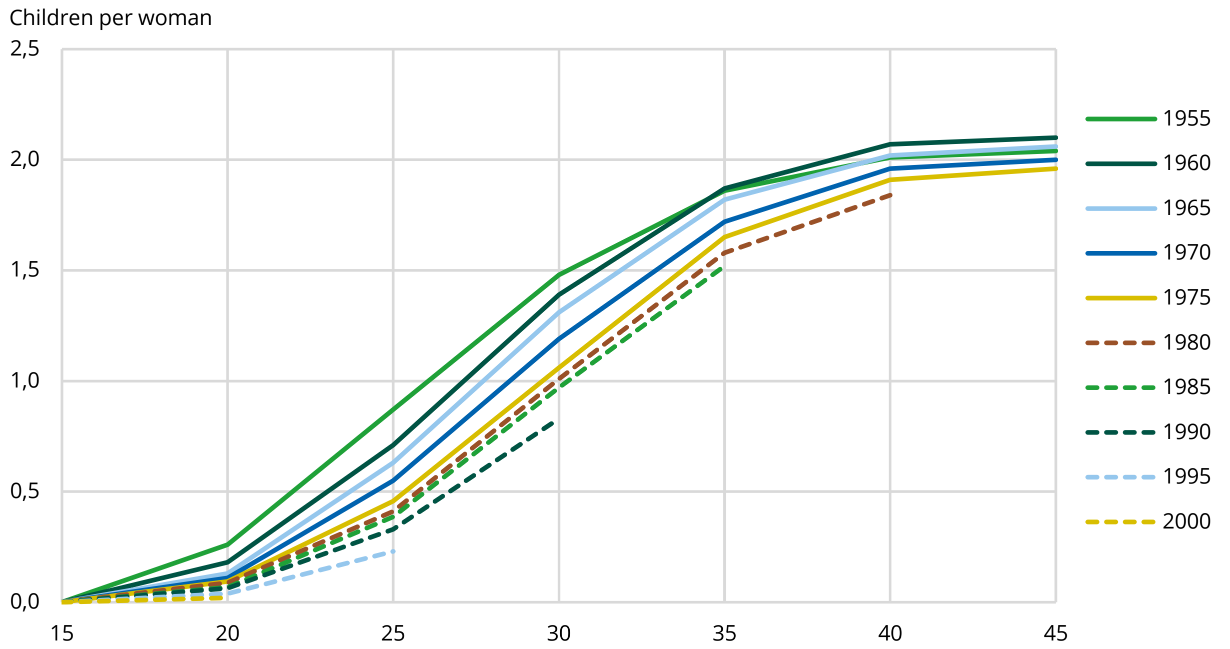
Source: Statistics Norway

Age at first birth, the spacing between children, and the total number of children across different parities all affect TFR. Moreover, while there were 500 more births in 2023 than in 2022, TFR slightly decreased year-on-year due to the large number of Ukrainian refugees arriving in those years. If we exclude the Ukrainians from the calculations, Norway had a stable TFR of 1.41 children per woman in 2023. If postponed births are indeed to be recovered, we would expect to see an increase in fertility in the coming years. It should be noted that the first quarter birth numbers for 2024 are higher than they have been in recent years. If this level of increase is replicated throughout the year, we can expect to see an increase in TFR in 2024.

Cohort fertility

When measuring period fertility (by TFR), there can be large fluctuations from year to year. Cohort fertility, the average number of children born to a specific cohort of women, is a more stable measure of fertility. Completed cohort fertility can only be measured when the cohort of women has surpassed childbearing age. By age 45, most women in Norway are finished having children and completed cohort fertility is therefore often measured at this age. Figure 5.6 illustrates the average number of children born to selected cohorts of women (1955-2000) by age. Although four of these selected cohorts (stippled lines) have not yet reached completed fertility ages, the figure illustrates differences between younger and older cohorts and can provide some idea of the degree to which delays to fertility are continuing. From the 1965-cohort onwards, the average number of children is lower at each age as we move to younger cohorts. Still, although there has been a reduction in completed cohort fertility, the differences between the completed cohorts are clearly smaller at age 45 than at age 30. This aligns with the discussion of ASFRs, where we see increasing fertility rates in older ages and declining fertility rates in younger age groups. The particularly low fertility observed thus far for the youngest cohorts may still be recovered as they move towards their later fertile ages. However, overall, the trends suggest that completed cohort fertility will be lower in the future. Women born in 1965, for instance, had a completed cohort fertility (in 2015) of 2.06 children, while women born in 1975, who turned 45 in 2020, had a completed cohort fertility of 1.96 children. The 1978 birth cohort turned 45 in 2023 and had a completed cohort fertility of 1.90 (Table 5.1).

Figure 5.6 Cohort fertility by age, selected cohorts of women, 1955-2000



Source: Statistics Norway

Table 5.1 displays the parity percentages for female birth cohorts. The decline in completed cohort fertility is underpinned by both a decline in women having three or more children and an increase in childlessness. Indeed, childlessness has increased from 9 percent among the 1945 birth cohort, to just under 15 percent for the 1978 birth cohort. The two-child norm has remained consistent since the 1945 birth cohort, with around 4 out of 10 women having two children.

Table 5.1 Parity percentages for female birth cohorts and completed cohort fertility, selected cohorts, 1935-1978

Year of birth	0 children	1 child	2 children	3 children	4+ children	Average number of children (cohort fertility)
1935	9.6	10.4	30.4	27.4	22.2	2.42
1940	9.5	10.1	33.7	29.1	17.6	2.35
1945	9.0	11.8	41.5	26.4	11.3	2.19
1950	9.4	13.3	45.4	23.5	8.4	2.08
1955	11.2	14.3	42.1	24.2	8.1	2.04
1960	11.9	13.8	39.4	25.6	9.2	2.10
1965	12.5	14.2	40.2	24.7	8.4	2.06
1970	13.4	14.7	41.2	23.1	7.6	2.00
1975	14.2	15.3	41.7	21.8	7.0	1.96
1978	14.7	16.5	41.3	20.7	6.8	1.90

Source: Statistics Norway

Childlessness

The increasing childlessness among women has been evident for many years. This pattern is not restricted to Norway, with childlessness among men and women aged 45 having risen over recent decades among all the Nordic countries, though to varying degrees. Finland has the highest childlessness with 19.5 percent in the 1976 cohort, while in recent years the trends in Sweden have started to decline again (Andersson 2009, Jalovaara et al. 2019, Hellstrand et al. 2021).

To get an idea about future childlessness, it can be useful to examine changes in patterns among women who have not yet completed their fertile years. The share of childless women by age 35 in Norway has seen a gradual increase from less than 20 percent among women born in 1970, to 25 percent among women born in 1986. Although a share of women aged 35 may want and will have children in the future, it is still likely that the proportion of childless women will continue to increase. As fecundity (i.e., the ability to conceive and carry a child to term) decreases from a certain age, and other life events and goals may thwart existing childbearing plans, not all fertility intentions will be realised.

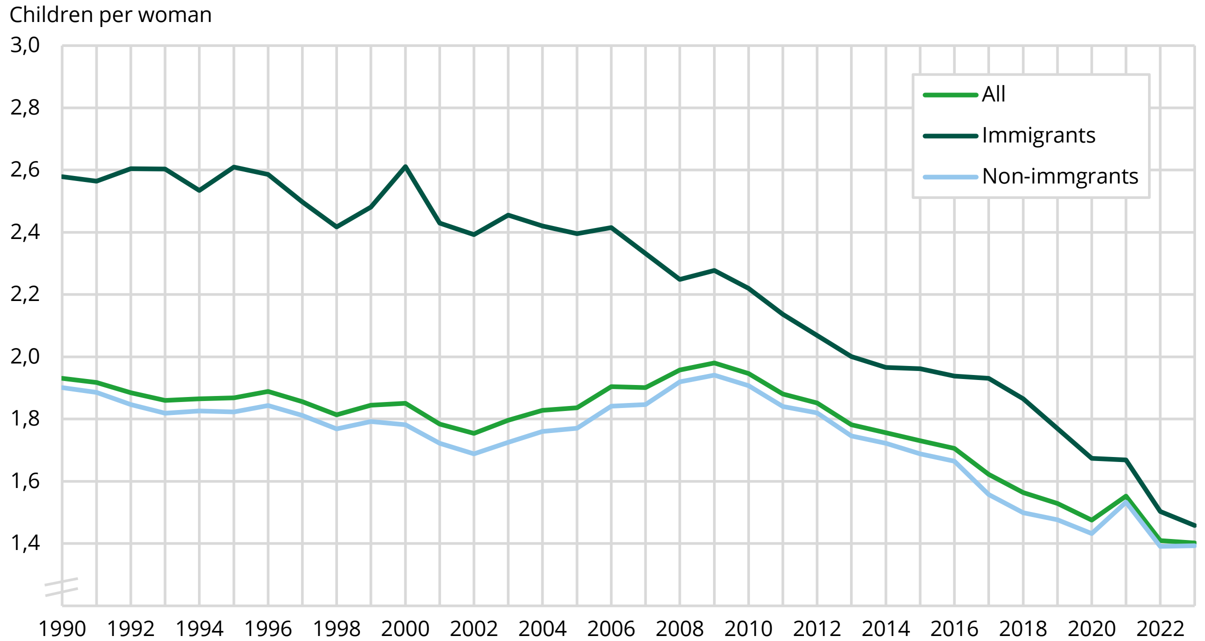
The impact of immigration on fertility

Figure 5.7 displays the registered TFR for immigrant women, non-immigrant women, and all women in Norway for the period 1990-2023. Despite a stronger decrease in fertility levels among immigrant women as compared to non-immigrant women over recent years, levels of fertility among immigrants remain higher than those of the rest of the population. Overall, the impact of differential immigrant fertility behaviour on TFR in Norway has been minor. Between 1990 and 2020, the positive impact of immigrants on TFR ranged between 0.3 and 0.7.

More recently, the positive contribution of immigrants to TFR has reduced. The TFR for non-immigrant women in 2023 was 1.39, while TFR for the entire resident population was 1.40. Thus, the childbearing behaviour of immigrant women only increased the TFR by 0.01. Part of this smaller contribution can be attributed to the scale and composition of recent Ukrainian refugee flows to Norway. The addition of a large number of women in fertile ages, but with extremely low fertility potential, has had a downward effect on TFR. For the total population, this effect was only minor, with a TFR of 1.40 with Ukrainian women, and 1.41 without, in 2023. The effect on TFR for immigrant women in Norway was obviously larger. TFR for immigrant women in 2022 was 1.5 and in 2023 1.46.

Even though the impact of immigrant women on overall TFR is small, the younger age profile of the immigrant population means they constitute a larger relative share of women in prime childbearing ages than the rest of the population. As a result, immigrant women do contribute significantly to the total number of births. In 2023, around 26 percent of all new-borns had an immigrant mother.

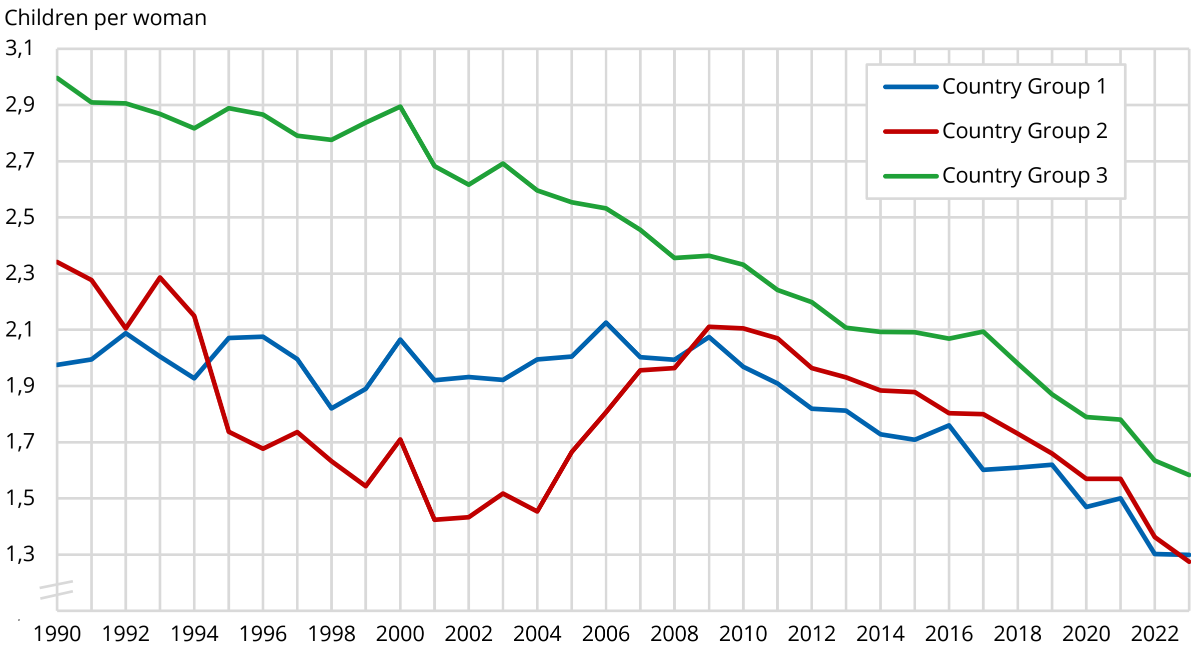
Figure 5.7 Total fertility rate by immigrant background, 1990-2023



Source: Statistics Norway

Figure 5.8 illustrates the development in TFR among immigrant women from the different country groups (see Box 4.3) for the period from 1990-2023. Immigrant women from Country Group 1 had a relatively stable fertility level of approximately two children per woman between 1990-2009. In line with the TFR for non-immigrants, Country Group 1 TFR then started to decline and was at 1.3 in 2023. Up to 2009, immigrant women from Country Group 2 had an average TFR of 1.8, although large fluctuations (between 1.4 and 2.4) are visible. The fertility trends of this group appear to be closely linked to the immigration patterns associated with EU accession. The rates were in relatively sharp decline prior to EU accession, which began in 2004, before they then sharply increased, peaking at around 2.1 children per woman in 2009. Since 2009, the TFR of Country Group 2 has again declined, reaching 1.27 in 2023. While immigrant women from Country Group 3 have the highest period fertility, we have witnessed a particularly strong decline for this group, from a TFR of 3.0 in 1990 to a TFR of 1.58 in 2023. Over the past decade or so, the general pattern suggests far more similarity in TFR between the immigrant groups.

Figure 5.8 Total fertility rate of immigrant women by country group, 1990-2023



Source: Statistics Norway

5.2. Assumptions of future fertility patterns in Norway

With the recent exception of 2021, we have seen a consistent decline in period fertility since 2009. Fertility has declined among immigrant and non-immigrant women, and particularly among women under 30 years of age. To form assumptions for fertility, we must consider whether this downward trend will continue, stabilise and/or reverse in the coming years.

The start of the period of declining fertility in Norway, and the Nordic region more broadly, coincided with the global financial crisis in 2008. Economic downturns have had a negative impact on fertility (Comolli et al. 2020), but the decline continued well after the economic crisis was over. Overall, the patterns observed in Section 5.1 do suggest a change in fertility preferences has occurred over time. Comparing cross-sectional survey data, a Finnish study finds that the ideal number of children is lower among younger birth cohorts (Golovina et al. 2024). Based on the observed trends in cohort fertility in Norway, fewer women appear to be opting to have three or more children and childlessness has slowly increased, especially among lower educated women (Jalovaara et al 2019). As such, completed cohort fertility has steadily declined with each passing cohort of women. Still, the decline in cohort fertility is far less dramatic than the decline observed in period fertility over the last 15 years, with the latter being greatly affected by tempo effects linked to the continued postponement of childbearing. The changes in ASFRs and the steady, though differential, increases in the mean age at first and the mean age for all births suggest women are having children later than before, though at greater intensities within these older age groups. When examining patterns of fertility decline, there has been a sharper decline in fertility among younger women, often in education. The combination of participating in higher education and lower fertility among female students is likely to contribute to the postponement of fertility. At the same time, there is a positive association between education and fertility in Norway (Kravdal and Rindfuss 2008; Jalovaara et al. 2019), meaning that completed fertility should at least not decline as a result of educational trends, given that most women go on to obtain a higher education in Norway. More generally, the two-child norm has been stable for many decades (Table 5.1) and is expected to remain important in the future (see Cools and Strøm 2020). If this is the case, the previous rate of increase in maternal age at first birth is unlikely to continue and we should soon expect to see an increase in TFRs as those women who have delayed fertility begin to realise their fertility preferences before the end of their fertile years.

From this perspective, we assume that future TFR in Norway will gradually increase from the historically low levels observed today (1.4 children per women). This is reflected in an assumed long-run TFR of 1.66 in the main alternative. It should be noted that as we move further forward in the projection period, projected TFR comes to approximate cohort fertility. The decrease in women who have three or more children, and an increase in childlessness, underpin why we do not expect fertility levels to return to their previous highs or the recently observed completed cohort fertility (1.9 children per woman for the cohort born in 1978). It is also the case that no other highly developed country has recovered to such high TFRs. We also provide low and high fertility alternatives, with the span between these alternatives illustrating the assumed degree of uncertainty surrounding the fertility projections.

5.3. The consequences of the assumptions for future fertility

In this section we will summarize the consequences of this year's assumptions for the future level of fertility, total number of births, and the population development. Figure 5.9 provides an overview of the registered and projected TFR according to the main (MMM), low fertility (LMM) and high fertility (HMM) alternatives. As mentioned in Box 5.2 below, the same percentage of change in fertility is used for all 16 groups of women (non-immigrant women and immigrant women in 15 combinations of duration of stay and country group). However, the difference in TFR between all women and non-immigrant women will not be exactly constant, as fertility among all women depends on the size and composition of the groups of immigrant women by country group of origin and duration of stay. This changes to some extent during the projection period and depends on the assumptions for future immigration (see Chapter 7 for details on the immigration assumptions).

Box 5.2 Calculation of fertility in the population projections

In the model that projects the population at the national level (BEFINN), we project fertility for different groups of women. We project the fertility for non-immigrant women, but also account for fertility differences between immigrant women in 15 combinations of country background and duration of stay in Norway. First, we find the starting level for the different groups, then we make assumptions about how we think fertility will develop in the future. The assumptions are primarily made based on considerations of the development in fertility for the non-immigrant women.

Fertility among non-immigrant women

First, we calculate the fertility of non-immigrant women. Norwegian-born with one or two immigrant parents are also included in this group. In order to determine the starting level of fertility among non-immigrant women, ASFRs are calculated according to observed data for the last registered year (2023 in this projection round).

The fertility of immigrants

Second, we project the fertility of immigrant women. They are divided into three country groups (see Box 4.3) and five groups based on duration of stay (1 year or less, 2-3 years, 4-6 years, 7-11 years, and 12 years or more). In total, this amounts to 15 combinations of country group and duration of stay. To find the baseline fertility level in the 15 different groups, age-specific fertility rates (ASFRs) for each group are calculated as an average of the last ten years. This is a weighted average wherein the last year of available data counts the most. We also make assumptions about the proportion of immigrant women who will have children with men who are also immigrants – to be able to calculate the number of Norwegian-born with two immigrant parents. These assumptions usually amount to a continuation of the current situation.

Fertility assumptions

Once we have calculated the baseline level of fertility in the 16 groups (i.e., non-immigrant women and 15 groups of immigrant women), we must make assumptions about how fertility will develop in the future. For each year of the projection period, we use a factor that adjusts the age-specific fertility rates up or down based on how we assume fertility will develop in the future. The annual factor is made in the three alternatives (low, medium, and high) and is applied to all the ASFRs in the given year. As such, we do not account for changing age schedules. The factors are set by Statistics Norway after discussions with an advisory reference group consisting of fertility researchers.

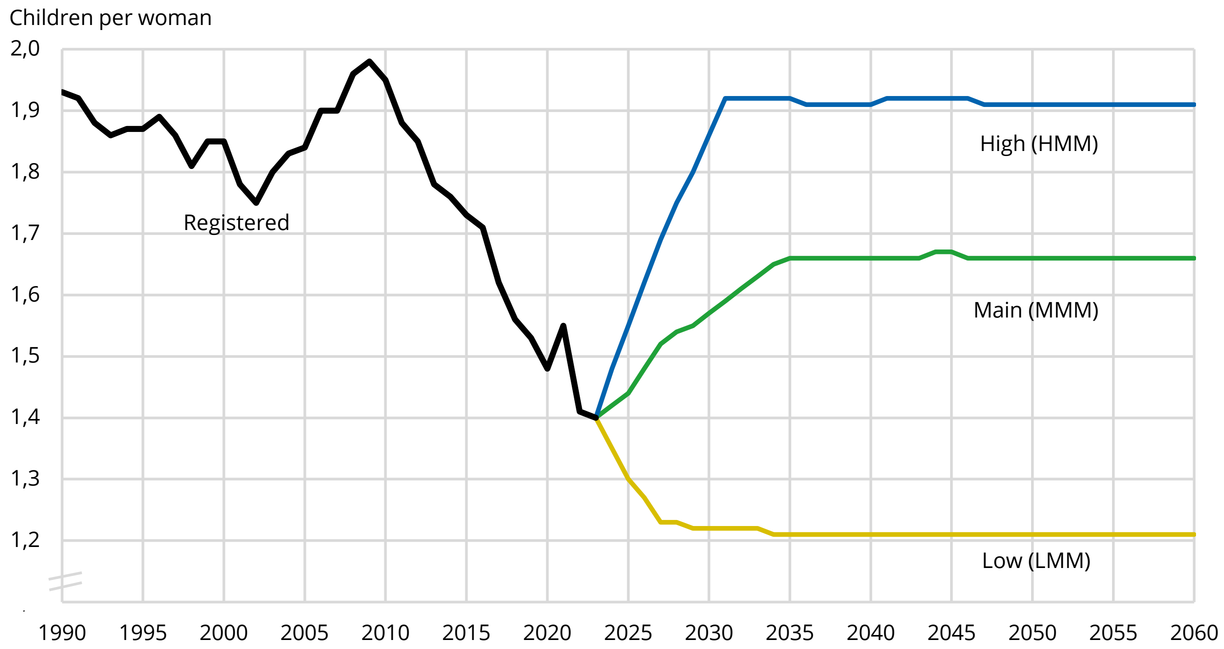
Since the same factor is used for all groups of women, one might assume that the differences in fertility between the immigrant women from each of the three country groups and the remaining women would be constant throughout the projection period. They are not. This is because immigrant women's fertility varies with their duration of stay, and because the number of immigrant women in different groups varies over time. During the projection period, most immigrant women will switch duration-of-stay groups several times, so that the composition of the 15 groups of immigrant women changes. This has consequences for how many women can potentially give birth in each duration-of-stay group, and also for how fertility will develop among immigrant women overall.

In the main alterative, we assume that the TFR for non-immigrant women will start to increase already in 2024, reaching 1.54 children per woman by 2030 and 1.64 by 2035. From 2035 onwards, we set it constant. For all women (including immigrant women), this results in a TFR of 1.57 in 2030 and 1.66 in 2035. Thereafter, overall TFR remains approximately constant, with some deviations occurring as a result of compositional shifts across sub-population categories.

In the low fertility alternative, we set the TFR for non-immigrant women to decline to a constant level of 1.20 from 2027 onwards. This corresponds to a constant long-run TFR of 1.21 for all women (including immigrant women). A TFR of 1.21 is lower than the lowest TFR observed in the Nordic region. Finland has the lowest fertility rate among the Nordic countries, TFR in Finland was 1.26 in 2023, and has had a lower TFR than Norway for almost every year since the 1960s.

In the high fertility alternative, we project the non-immigrant women TFR to increase to 1.89 after 2030, and from there it remains constant. This corresponds to an approximately constant long-run TFR of 1.91 for all women (including immigrant women). The decline in cohort fertility, the steady increase in childlessness, as well as fewer women having three or more children, underpins our assumption that we will not return to a two-child per woman average, even in the high alternative.

Figure 5.9 Total fertility rate, registered 1990-2023 and projected 2024-2060, in three alternatives

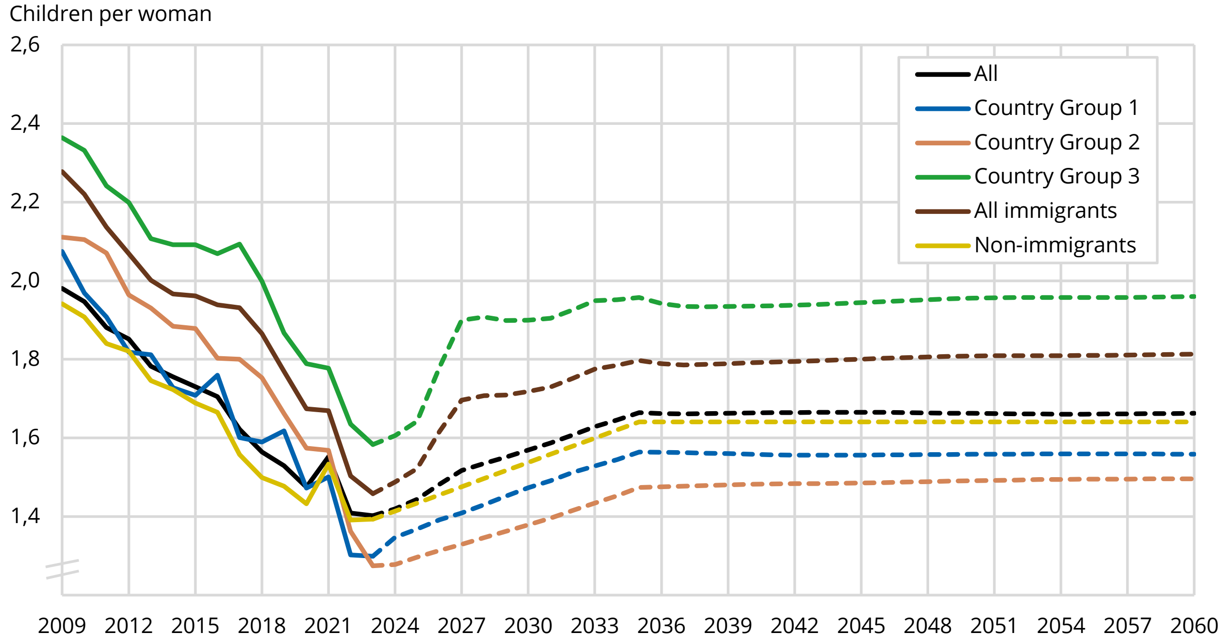


Source: Statistics Norway

Figure 5.10 presents the registered and projected (MMM) TFR for all women, all non-immigrant women, all immigrant women, as well as for separate immigrant country groups for the years 2009-2060. While immigrant fertility is projected to remain higher than non-immigrant fertility, this is driven by the relatively high TFRs for Country Group 3. Immigrant women from Country Groups 2 and 3 are projected to have lower TFRs than the non-immigrant population. Even though the share of immigrants in the population is expected to increase, the contribution of immigrants to the total TFR will remain low. Much of the growth in the immigrant population will take place among older ages and among immigrants with long durations of stay (see Chapter 7), characteristics that are not associated with especially high fertility rates.

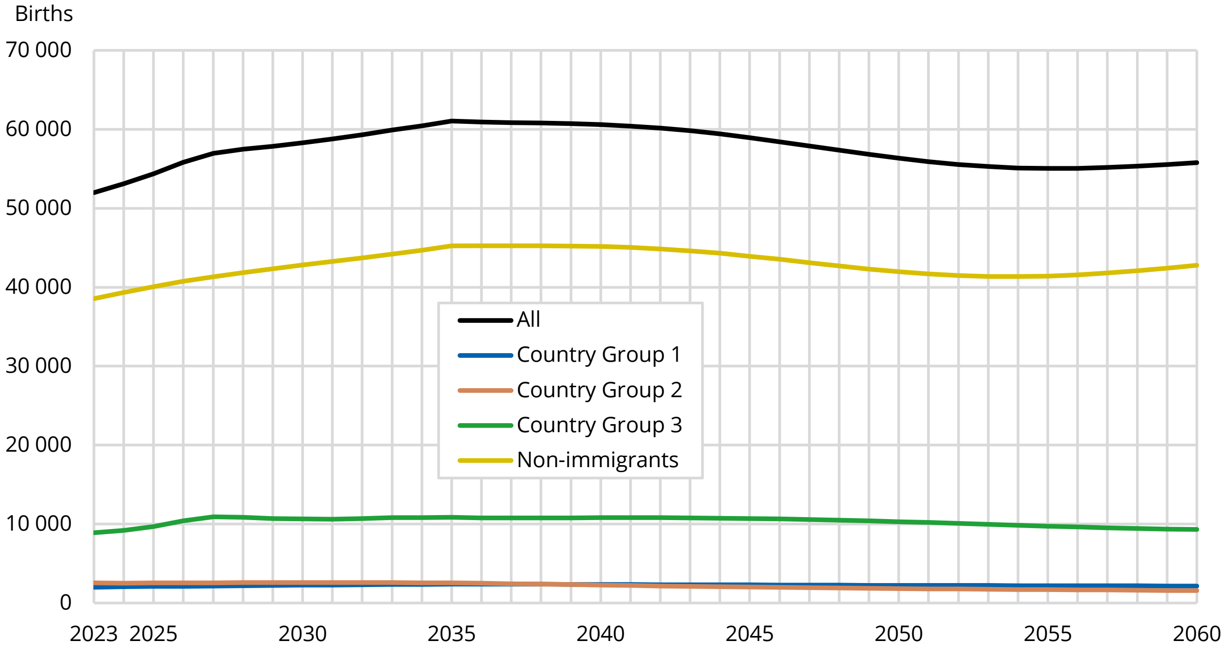
Figure 5.11 shows the projected development in the main alternative (MMM) in the number of births. The number of future births is determined by both the assumed fertility levels, as well as by the number and age composition of women of childbearing ages (15-49 years). According to our main alternative, the number of births to all women in Norway will increase from around 52 000 in 2023 to approximately 60 000 in the 2030s and 2040s, before a decrease is observed to around 55 000 in 2050. Non-immigrant women will clearly contribute most births (between 40 000 and 45 000 annually), with immigrant women from Country Group 3 contributing the next highest amount, at around 10 000 annually up to 2050.

Figure 5.10 Total fertility rate for different groups of women, registered 2009-2023 and projected 2024-2060, main alternative (MMM)



Source: Statistics Norway

Figure 5.11 Number of births to different groups of women, registered 2023 and projected 2024-2060, main alternative (MMM)



Source: Statistics Norway

Box 5.3 Changes from the last projection

In the main alternative of the 2022 projections, the long-term fertility level was set at approximately 1.7 children per woman. The long-term level was based on the assumption that the preference to have more than two children has declined (as suggested by the patterns observed in Table 5.1). For the short term, the assumption was that fertility would continue to decline before then increasing towards its long-term level. The registered number of births was 3 200 lower than projected in 2022 and 2 600 lower than projected in 2023. The 2022 projections assumed a TFR of 1.50 in 2022 and 1.49 in 2023, whereas actual TFR fell to 1.41 in 2022 and 1.40 in 2023.

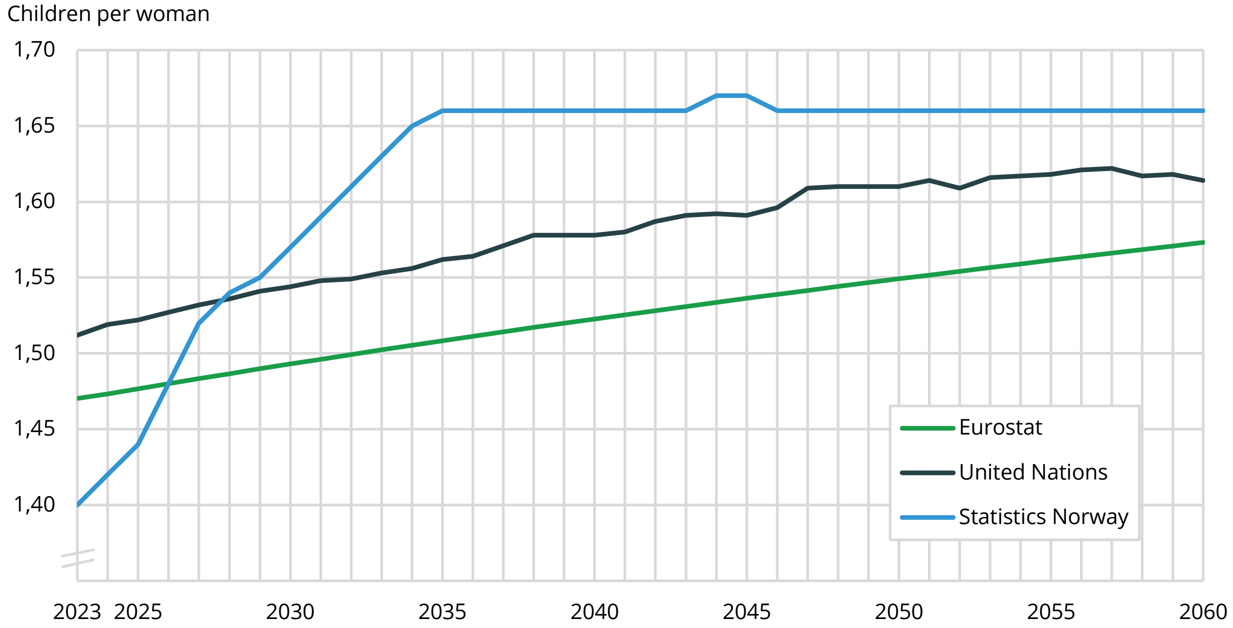
This year's main alternative also assumes an increase from today's TFR, though to a somewhat lower long-run level of 1.66 from 2035 onwards. This however does not translate into a lower number of total births. In 2030, the 2024 main alternative projects around 1 300 more births than the 2022 main alternative. In 2050, the 2024 main alternative projects 700 more births. The differences between projections steadily decline until the 2080s, when the new projected total number of births starts to be less than was projected in the 2022 projection model. The slightly higher number of total births in the 2024 projection round is linked to a higher number of projected births to immigrant women, which in turn results from the overall higher level of immigration (see Chapter 7). The number of projected births to non-immigrant women is now approximately 1 000-2 000 lower per year than it was in the 2022 projection round.

Fertility is the only component for which we do not employ a model in our assumption work. Gleditsch et al. (2021) undertook a survey to identify the different approaches used to project fertility among statistical agencies in Europe and to provide an assessment of the different approaches according to the producers themselves. This survey revealed that most agencies combine formal models with expert opinion. We are currently examining the potential of a model-based approach for future projection rounds.

5.4. Projected fertility from alternative producers

Both Eurostat (2023) and the United Nations (2022) publish fertility projections for Norway. As well as methodological differences, there are also differences in the projected age composition between the projections, as well as in terms of population size, which both impact the future TFR. Figure 5.13 shows a comparison of the medium fertility assumptions for Norway produced by Eurostat, the United Nations, and Statistics Norway. As the figure illustrates, all three projections have different trajectories for future developments in fertility but agree in assuming that fertility will increase in the coming years. The United Nations and Eurostat projections began in 2022, and hence start from a higher baseline, but expect a less sharp and overall lower increase in fertility compared to the medium fertility assumption of Statistics Norway. The United Nations projections are closest to our own in the long run, with the United Nations assuming 1.61 children per woman in 2050, as compared to 1.66 for Statistics Norway and 1.55 for Eurostat. As the three projections approach 2100, the differences become very small, at around 0.01-0.02 children per woman.

Figure 5.13 A comparison of medium fertility assumptions for Norway produced by Eurostat, United Nations, and Statistics Norway, 2023-2060

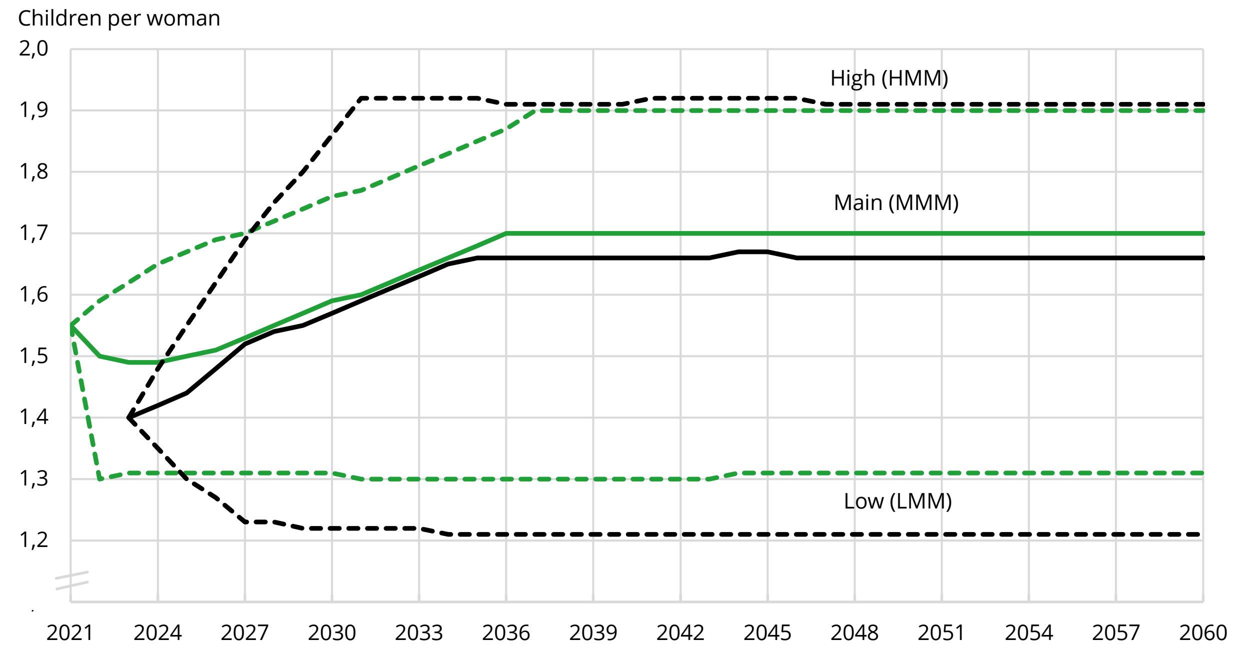


Source: Eurostat, United Nations, and Statistics Norway

5.5. Changes in the fertility assumptions from the last projection

As shown in Figure 5.14, both the 2022 and 2024 main alternatives of Statistics Norway assumed a short-term increase in fertility over the coming decade. In the long run, however, the 2024 main alternative is lower than the previous round, at 1.66 as compared to 1.70 children per woman. The long-run low alternative is also now 0.1 children per woman lower than in the 2022 projection round, while the high alternative is only marginally higher (at around 0.01 children per woman) as a result of a small increase in the contribution of immigrant women to the overall TFR.

Figure 5.14 A comparison of fertility assumptions in the 2022 (green) and 2024 (black) projections in three alternatives, 2021-2060



Source: Statistics Norway

5.6. Summary

Period fertility in Norway (as measured by TFR) ranged between 1.7 to 2.0 for the period 1990-2009. It has since followed an (almost) continuous decline, with fertility levels reaching an historic low in 2023, at 1.40 children per woman. Both tempo (timing) and quantum (level) effects underpin this decline. First, women have been postponing births and, second, we have observed an increase in childlessness as well as a smaller share of women choosing to have three or more children. With that said, cohort fertility suggests the two-child norm remains strong, and we expect this to be the case in the future too. From this perspective, we assume an increase in TFR in the coming years as the average age of childbearing starts to stabilise and postponed births become realised. While there is great uncertainty associated with the extent to which postponed births will be recovered in the future, we view it as highly unlikely that the downward trend in third births and higher order parities will change. The current fertility projections are based on the historical development of fertility and in the main alternative we have projected a gradual increase to a long-run TFR of 1.66 children per woman. In the low fertility alternative, we project that the TFR will decline from its current level to approximately 1.21 children per woman, while the high fertility alternative assumes a long-run TFR of approximately 1.91 children per woman.

6. Life expectancy and mortality – Assumptions and results

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Since 1990, life expectancy at birth has increased by 7.9 years for men and 4.8 years for women. By 2050, the medium life expectancy alternative projects life expectancy at birth to increase by a further 4.6 years for men and 3.7 years for women. More specifically, we assume male life expectancy at birth will increase from 81.4 years in 2023, to 86.0 (low 83.3, high 88.4) years in 2050 and 92.1 (low 87.3, high 96.3) years in 2100. For women, an increase from 84.6 years in 2023 to 88.3 (low 85.9, high 90.5) years in 2050, and 93.4 (low 89.0, high 97.3) years in 2100, is assumed. Uncertainty increases the further forward we project from the base year. Statistics Norway places most confidence on the medium alternative, and we consider an 80 percent likelihood that the future value will lie within the low and high alternative bounds.

In line with the assumed improvements to life expectancy, the number and share of older persons is expected to increase considerably, with strong growth even among the very oldest old (i.e., 90+). According to the medium alternative, life expectancy among 70-year-old men and women is projected to be around 3 years higher by 2050. Even for 80-year-old men and women, life expectancy is expected to be around 2 years higher by 2050. Those aged 70 and over represent 13 percent of the population today, whereas by 2050 the main alternative projects this share to have grown to 20 percent. The growth in the share of people aged 80 and over is expected to be particularly strong – increasing from approximately 5 percent today to approximately 10 percent by 2050.

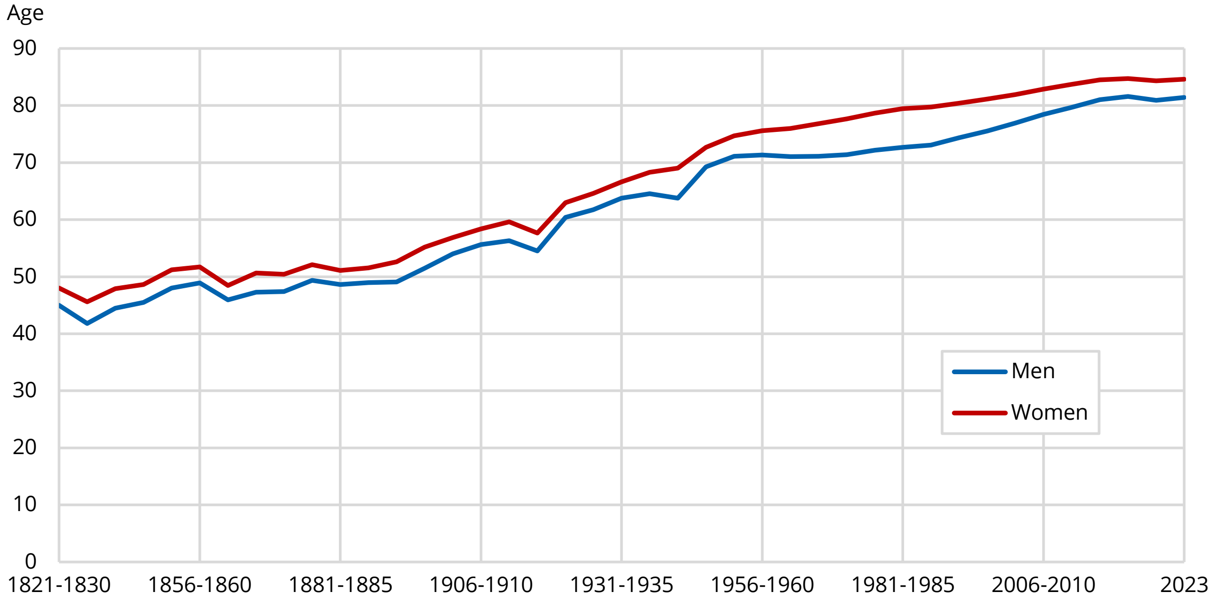
6.1. Trends in mortality and life expectancy

Period life expectancy and sex differentials

Period life expectancy at birth (Box 6.1) has steadily increased over many decades (Figure 6.1). However, while it reached an historical peak for both men (81.6 years) and women (84.7 years) in 2021, 2022 witnessed a decline in life expectancy of 0.7 years for men and 0.4 years for women as a result of the effects of the COVID-19 pandemic. We have to go all the way back to the early 1960s to observe the last decline in life expectancy among men and as far back as 1916-1920 for the last decline among women. Life expectancy increased again in 2023 and is now just 0.2 years lower for men and 0.1 years lower for women than in 2021.

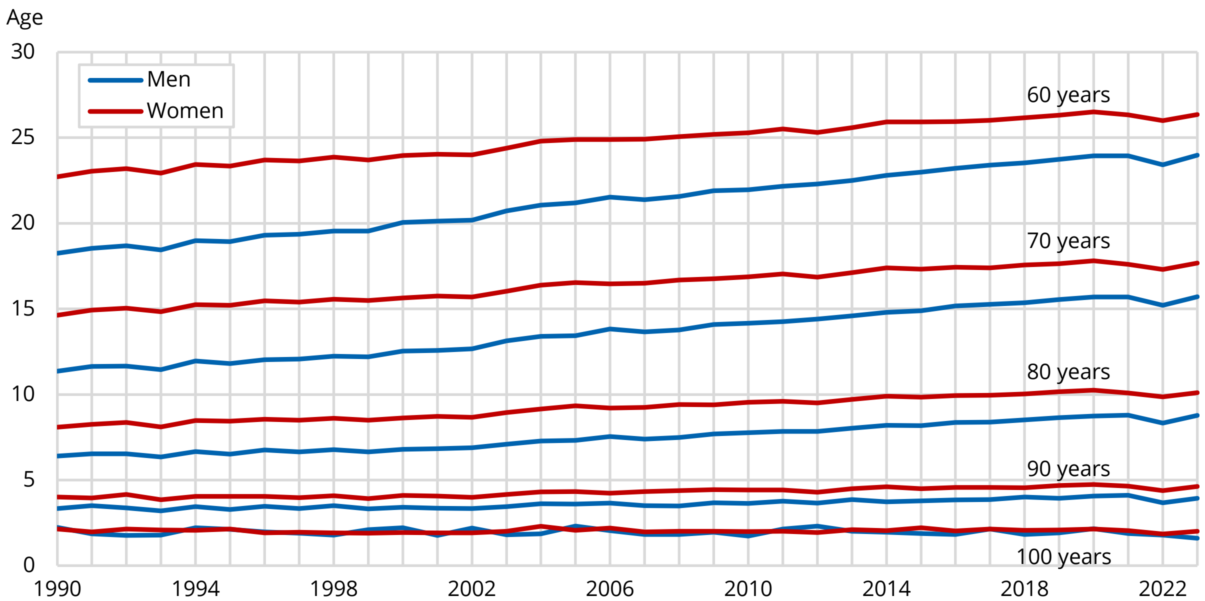
The differences between men and women in life expectancy have been generally decreasing in recent decades. In 2023, the difference in period life expectancy at birth was 3.2 years. Aside from 2021, this difference is the smallest we have observed since the early 1930s (Figure 6.1). In 1990, the difference between men and women stood at 6.4 years. Nevertheless, there still exists a relatively large gap between the sexes in terms of life expectancy. In 2023, new-born boys had an average life expectancy at birth equivalent to that of new-born girls in 2000, that is, more than two decades earlier.

Figure 6.1 Life expectancy at birth for men and women, 1821-2023[1]



[1] Life expectancy at birth is presented in 10-year groupings for 1821-1850, five-year groupings for 1851-2020.
Source: Statistics Norway

Figure 6.2 Life expectancy at selected ages for men (blue) and women (red), 1990-2023

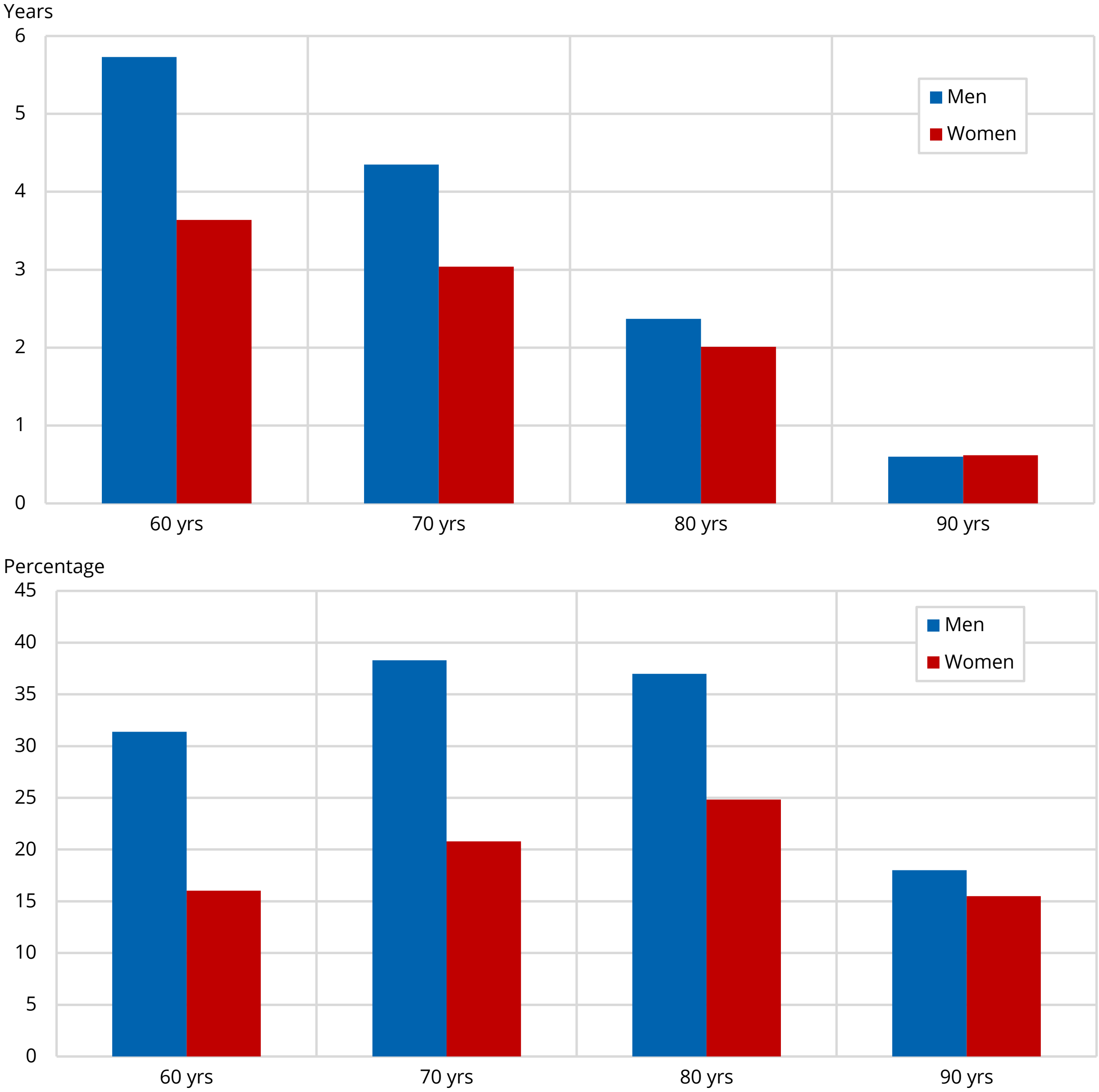


Source: Statistics Norway

Along with life expectancy at birth, remaining life expectancy is calculated for all ages up to and including 105 years (Box 6.1). As is clear from Figure 6.2, the difference between men and women in remaining life expectancy decreases with age – at only 0.4 years for the very oldest age groups (100 years or older) in 2023. Thus, men who reach 100 years of age appear to have very similar remaining life expectancy prospects to equivalently aged women – N.B. the limited number of people aged 100 or older means these estimates are particularly uncertain.

For age groups under 30, the difference in remaining life expectancy between men and women is around three years, and above two years for those up to their late sixties. It is only in the late eighties that estimated sex differences fall below one year. Both in terms of years and as a percentage increase, the period 1990-2023 has witnessed a stronger increase in remaining life expectancy for men than women (Figure 6.3).

Figure 6.3 Changes in remaining life expectancy by sex from 1990 to 2023 for selected age groups, years (top) and percentage (bottom)



Source: Statistics Norway

Box 6.1 Period life expectancy at birth and remaining life expectancy

Period life expectancy at birth (e0) is a hypothetical period measure and represents the average number of years a person can be expected to live according to the mortality experience of the entire population in a single year. For each year in the projection period, we calculate life expectancy at birth for men and women separately, as well as for men and women combined.

As with life expectancy at birth (e0), remaining life expectancy (ex) is calculated using age-specific death rates covering a single calendar year (e.g., for a period life expectancy at age 70 in 2025, we would use projected mortality rates in 2025 for ages 70, 71, 72, ..., 105). We calculate the expected remaining years of life for each single-year age group up to and including 105 years.

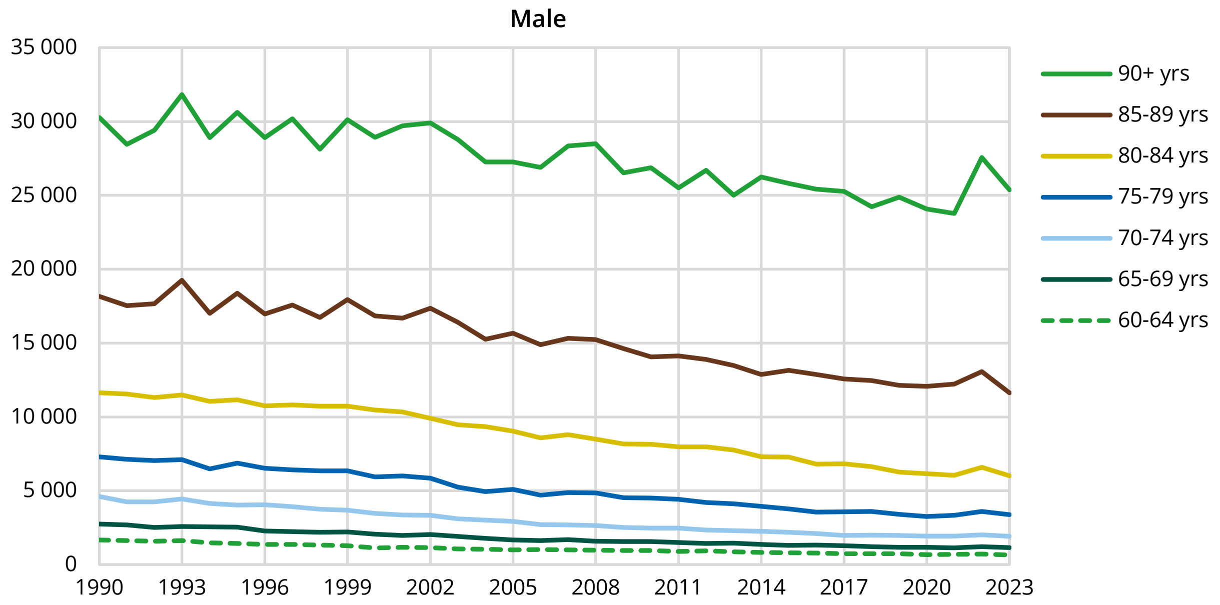
In the projections, the estimates of period life expectancy are based on age at the end of the year and not at time of death, as they are in the general population statistics. This results in a deviation of just under half a year.

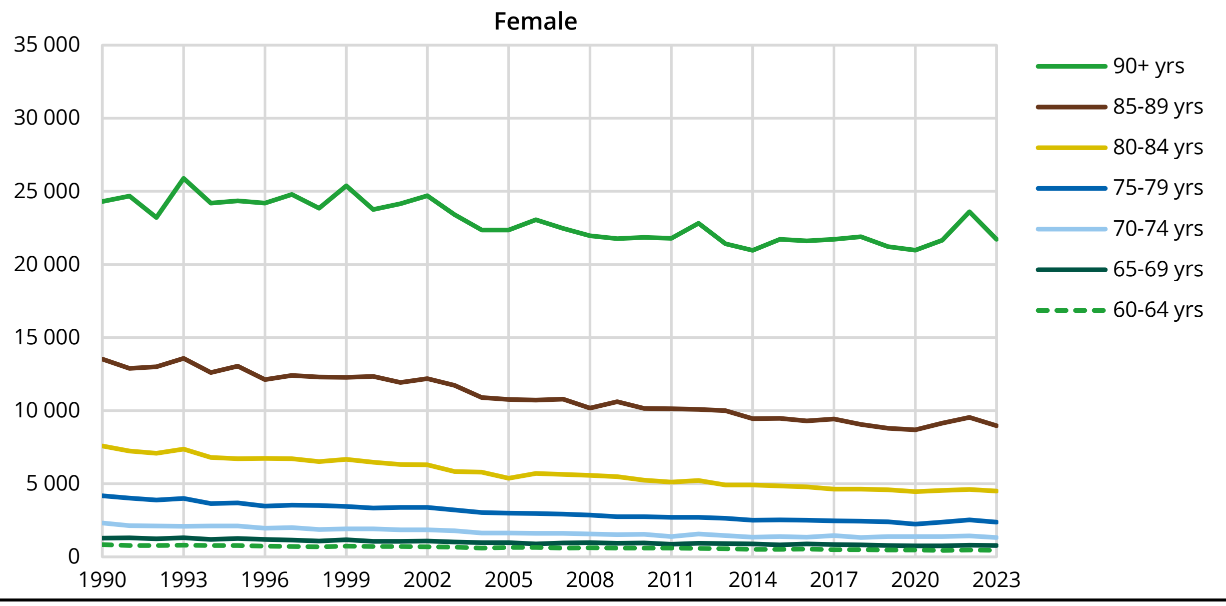
Trends in deaths and the causes of death

Since the year 2000, the fall in mortality has been especially strong among the oldest age groups, and particularly among the oldest men (Figure 6.4, top). For women, while mortality has still declined, it has been a somewhat more gradual process (Figure 6.4, bottom). Because mortality rates in younger age groups are very low, the increase in life expectancy in recent decades is mainly a consequence of older people living longer.

As with life expectancy, the average age at death also differs between the sexes. In 2023, the average age at death was 81.9 years for women and 76.9 years for men. This compares to 1990 when the average age at death was 78.2 and 72.0 years for men and women, respectively. The change in the modal age at death, which reflects the most common age at death (the peak in Figure 6.5), has been stronger, increasing from 76 in to 84 years for men and from 84 to 92 years for women over the same period. The rightward shift in the apex of the distribution of deaths by age is eight years for both men and women and thus the difference between men and women in terms of modal age at death is the same in 2023 as in 1990, at eight years.

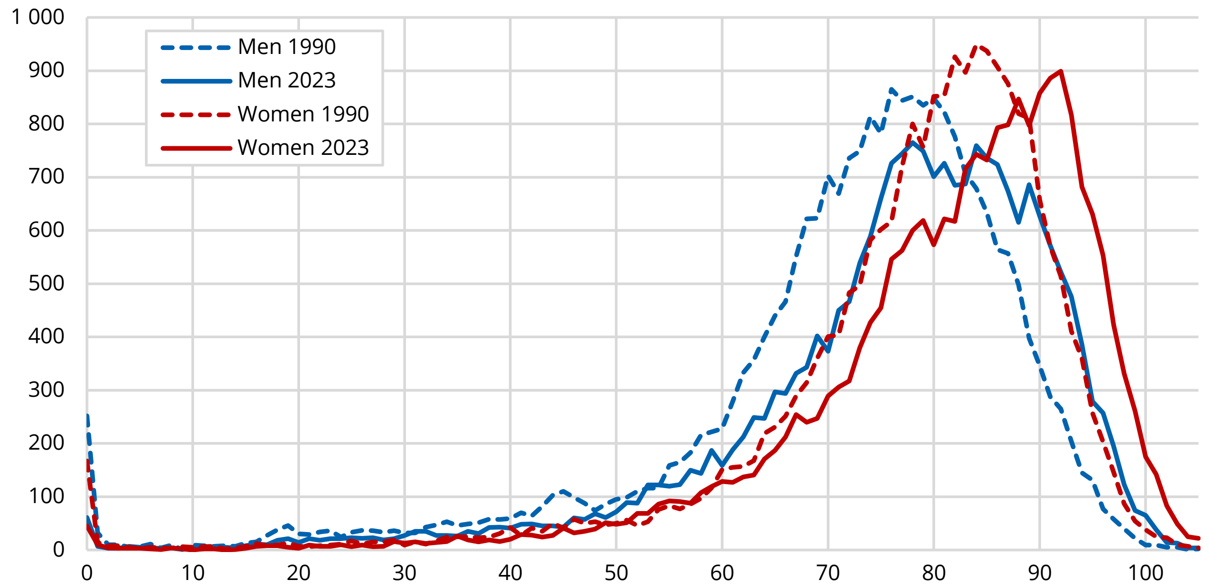
Figure 6.4 The number of male (top) and female (bottom) deaths per 100 000 of the mid-year population by age, 1990-2023





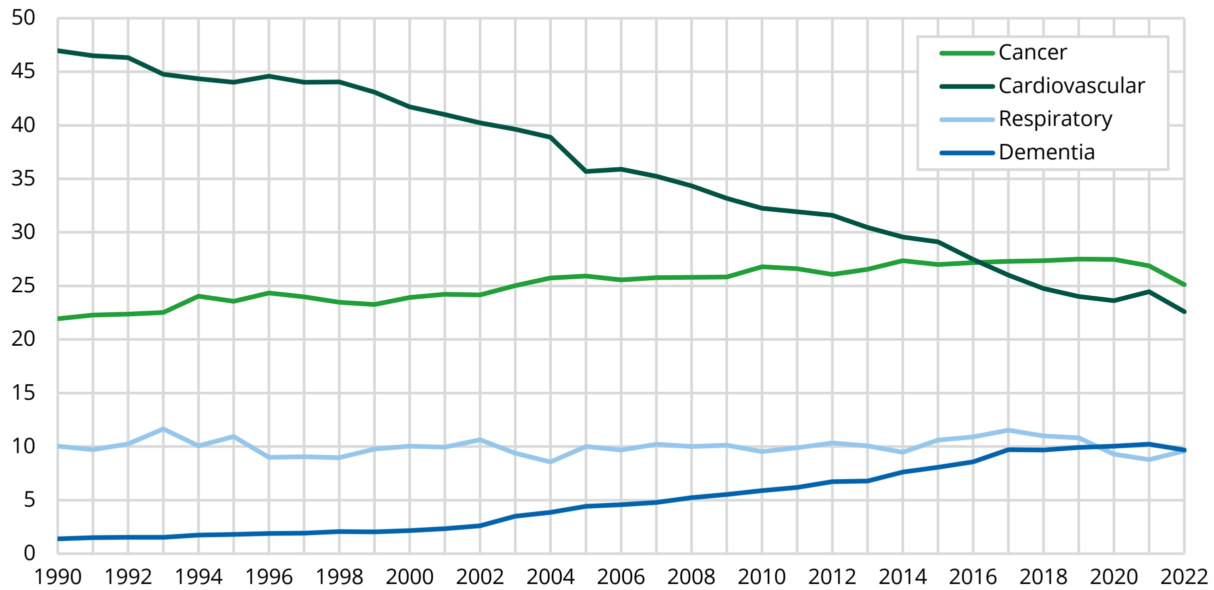
Source: Statistics Norway

Figure 6.5 Distribution of deaths by age and sex in 1990 and 2023



Source: Statistics Norway

Figure 6.6 Four major causes of death in Norway as a percentage of all deaths, 1990-2022



Source: Norwegian Institute of Public Health

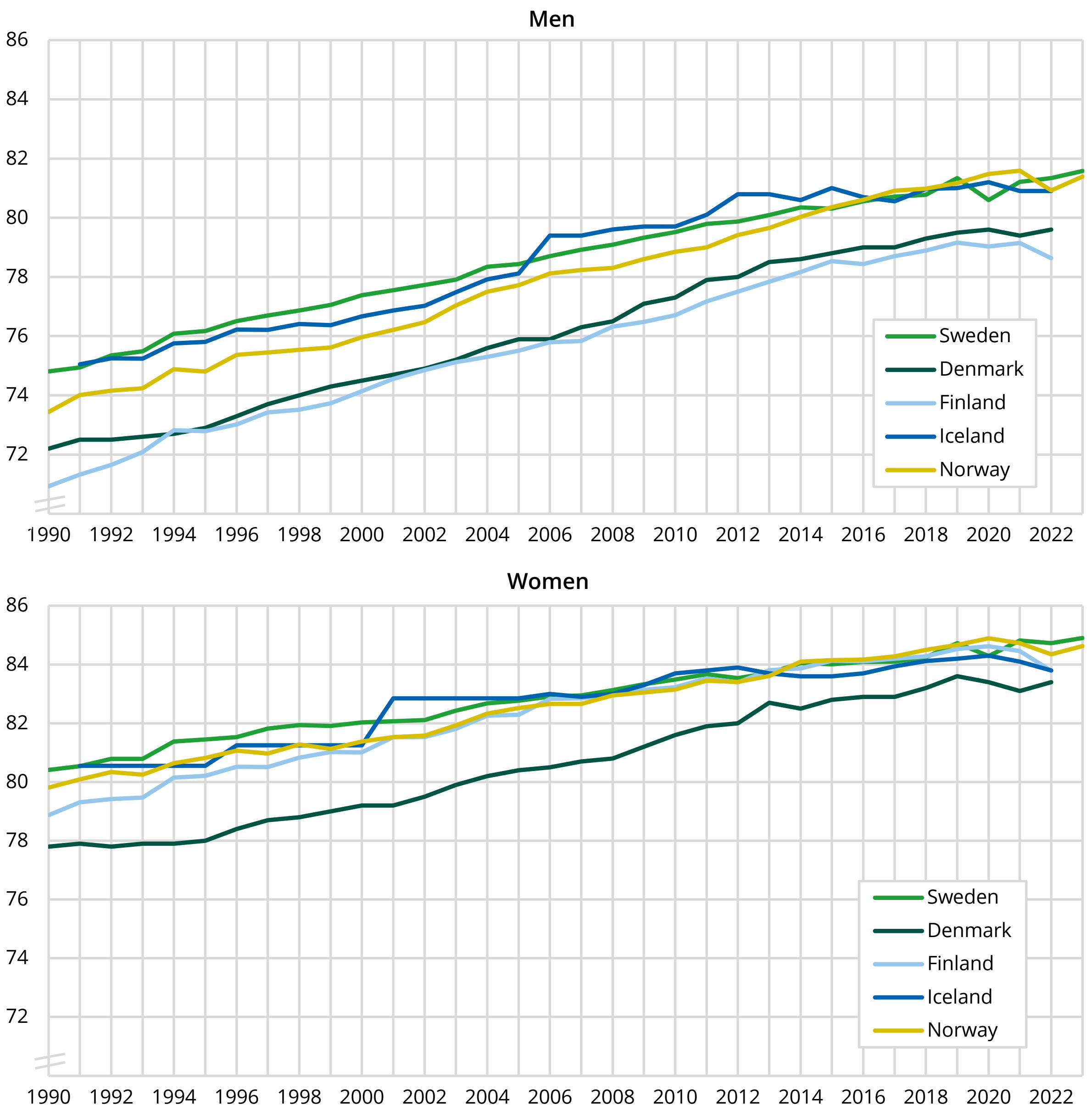
Figure 6.6 shows the development over time in the share of deaths by selected causes of death. Cardiovascular disease constitutes an ever-smaller proportion of all deaths, with the decline being particularly noticeable from the late 1990s. Figures from the Cause of Death Registry reveal that less than 25 percent of all deaths in 2022 were due to cardiovascular disease, this compares to almost half (47 percent) of all deaths in 1990 (NIPH 2024). While the proportion of deaths from cardiovascular disease has dropped significantly over time, the proportion of cancer-related deaths has increased – from just over one-fifth (22 percent) in 1990 to a peak of 27 percent in 2020 (NIPH 2024). Indeed, 2017 was the first year in which cancer deaths accounted for a larger share of deaths than cardiovascular disease. This is mainly a result of the population being older, with the age-standardised death rates for cancer declining over the past decade (Cancer Registry of Norway 2021). The proportion of deaths related to respiratory diseases (excluding cancer and COVID-19), which are largely linked to smoking, has been relatively stable since 1990, at around ten percent.

However, the mortality rate associated with dementia has been increasing since 2000 (NIPH 2019). In 2023, dementia accounted for around 10 percent of deaths, which is almost five times larger than the relative share observed in 2000. While this increase is also likely linked to an ageing population, there have been improvements in the identification of dementia as the underlying cause of death.

Norwegian trends in an international context

Figure 6.7 shows the development in life expectancy as calculated by the national statistical agency of each Nordic country. Since 1990, Norway has had a consistently higher male life expectancy than Finland and Denmark (Figure 6.7, top). Moreover, while Sweden and Iceland have tended to have had a higher life expectancy than Norway over this same period, a catch-up has been observed over the last decade. For the past two decades, the level and relative increase in life expectancy at birth among women has been very similar across Norway, Sweden, Iceland, and Finland, and while Danish women have a lower life expectancy than the rest, there has been a gradual process of convergence towards the rest of Nordics.

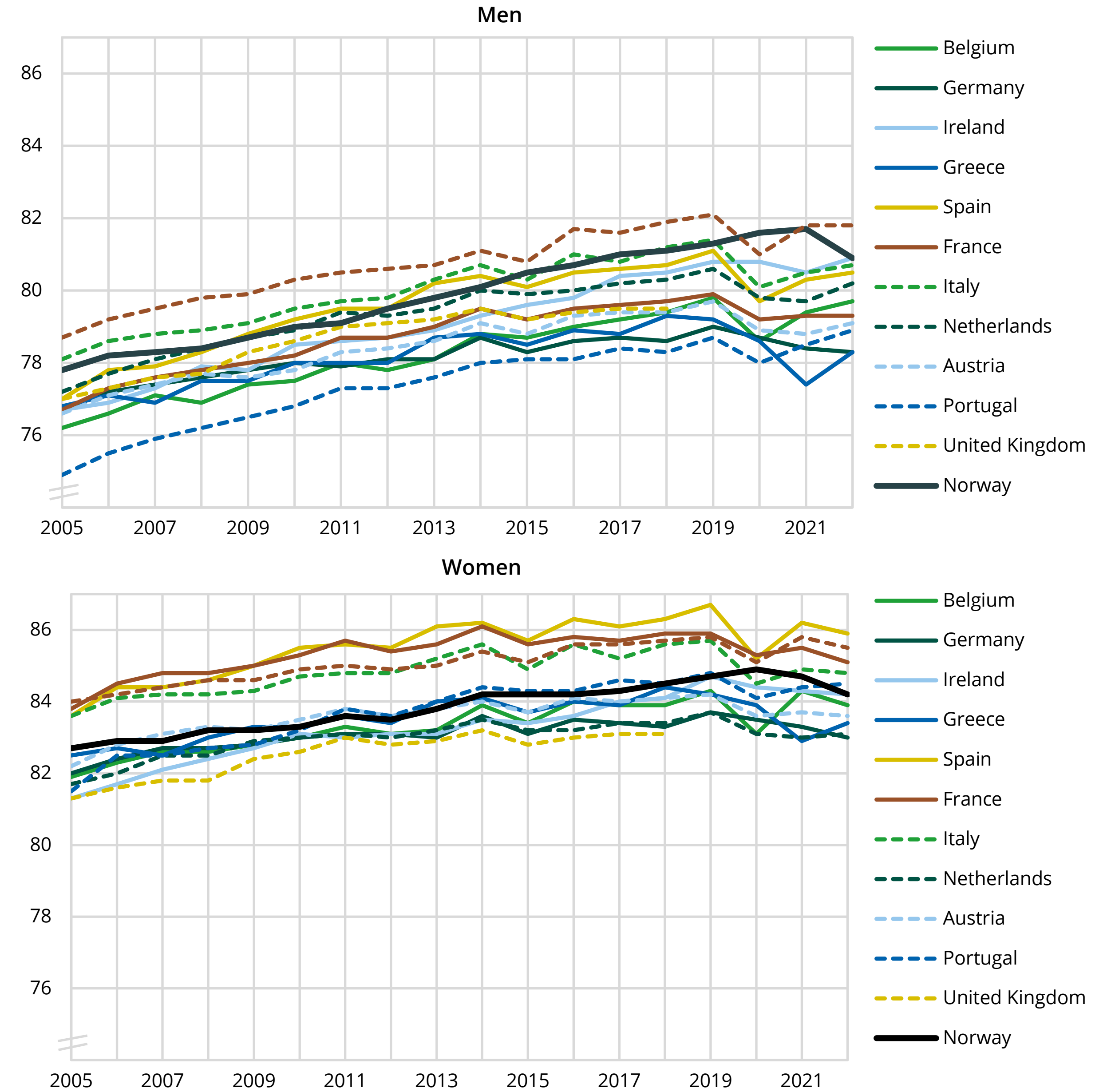
Figure 6.7 Life expectancy at birth for men (top) and women (bottom) in the Nordic countries, 1990-2023



Source: National statistical agency for each country

Europe has experienced large gains in life expectancy over recent decades, though there are occasions when wide-ranging declines have occurred. For instance, in 2014-2015, two-thirds of European countries experienced a decline in male life expectancy, while three-quarters observed a decline in female life expectancy (Eurostat 2020). By 2016, life expectancy in most countries increased again. As can be seen in Figure 6.8, Norway was among the few countries that did not witness a decline in life expectancy during this period. More recently, we can observe the negative effects of the COVID-19 pandemic. Life expectancy at birth in the EU was 0.8 years lower for women and 1.0 years lower for men in 2020 as compared to 2019 (Eurostat 2024). Life expectancy also decreased in all EFTA countries in that year except Norway, where both male and female life expectancy continued to increase (Eurostat 2024). However, by 2021, Norway did witness a decline in female life expectancy and in 2022 we observed a decline for both sexes. Zahl et al. (2024) provide an analysis and discussion of the different mortality experiences of Norway and Sweden during the COVID-19 pandemic, contrasting the effects of the stricter lockdown policy in Norway to the more relaxed policy in Sweden.

Figure 6.8 Life expectancy at birth for men (top) and women (bottom) in selected European countries, 2005-2022



Source: Eurostat

6.2. Modelling future mortality

The assumptions about future mortality and life expectancy are mainly model based and determined by historical trends in mortality. In short, we make assumptions about future mortality by age and sex using the product-ratio variant of a Lee-Carter model, where the trend in mortality for the selected time period, represented by two estimated time series, is extended using an autoregressive integrated moving average (ARIMA) model. This is described in more detail in Section 4.2. The historical period used as a basis for the projections is determined prior to each projection round. If it seems appropriate, discretionary adjustments are also made to the model work.

As the previous sections have shown, the pattern of mortality is different today than it was in earlier periods. We have a lower prevalence of smoking, cardiovascular disease is in decline, and the last decade has witnessed important advances in medical science and technology in the areas of stroke and cancer treatment. For this reason, it is reasonable to expect that future mortality trajectories will be closer to those observed in recent decades, than in the 1980s and 1990s, for example. Moreover, detailed evaluations of past projections have shown that Statistics Norway has often underestimated the increase in life expectancy (Keilman 1997, Thomas et al. 2022). In 2016 and 2018, the historical time series started in 1990. Given the recent trends in cause-specific mortality, as well as the expected developments in medicine and technology, the 2020 projections utilised a time series of registered data starting in 2000. The use of a time series starting in 2000, as compared to 1990, had the desired effect of increasing life expectancy without greatly increasing the prediction intervals around the estimates (Syse et al. 2020). This year's projections utilise a time series covering the years 2000-2023 (Box 6.2).

Box 6.2 Data

The figures for the number of deaths and the size of the population are taken from Statistics Norway's population statistics and the period 2000-2023 forms the basis for the calculations. Age-specific death rates (0-90 years) for each calendar year for men and women, and for both sexes combined, are calculated using a formula for piecewise constant death intensity (Foss 1998). When calculating age-specific rates, age is defined as age at the end of the calendar year. When the death rates are calculated, they are corrected for extreme values. Extremely low death rates, or cases where there are no deaths in some age groups and/or years, are replaced by the average of the rate for the age group before and after.

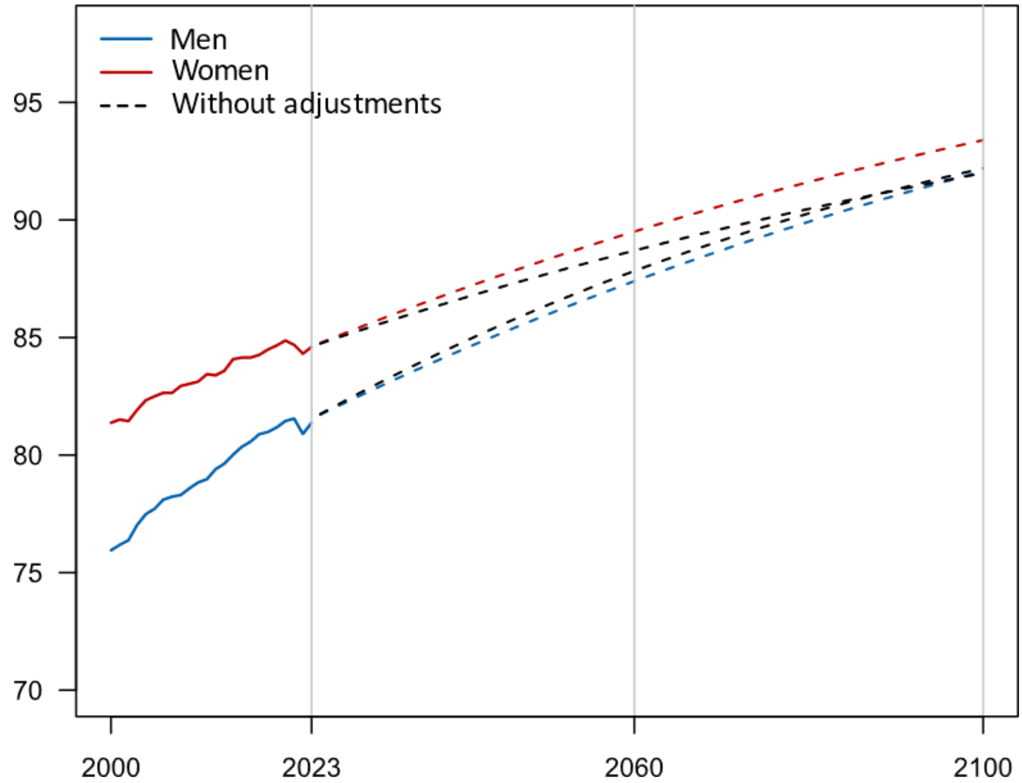
There are often large fluctuations from year to year for ages 101-110. Therefore, to estimate projected death rates for these age groups, a logistic model has been used to extrapolate and smooth the estimated death rates for ages 101-110 years. Input in this model is death rates for the age groups 70-100 years in the period 2000-2023. This reduces the noise in the estimates at high ages and provides stable projected death rates for the entire age range. For ages 110-119 years, the probability of death is set at 0.5 for both men and women throughout the period.

Discretionary adjustment

Since male life expectancy has increased more than female life expectancy over recent decades, a purely mechanical model-based approach to extrapolations will lead to crossovers in the death rates of men and women in the relatively near future. We consider it unlikely that men will have a higher life expectancy than women in the coming decades. This is partly because we have no evidence for such a trend occurring in modern times in societies similar to Norway, and partly because both the previous disparity between the sexes, and the recent 'catch-up' among men, is linked to changes in cardiovascular mortality and other smoking-related causes of death. Since men, on average, stopped smoking earlier than women, we assume that smoking-related mortality will contribute less in the future than it did in the 1990s and 2000s. A discussion and explicit incorporation of lifestyle-related effects (e.g., smoking, alcohol and obesity) in life expectancy projections in the European context was provided by Janssen et al. (2021). Janssen et al.'s (2021) projections lend support, at least qualitatively, to the assumed reduction in the effect of smoking.

Bearing these points in mind, we decided to adjust the trajectories so that there are around two years between male and female life expectancy at birth in 2060. Figure 6.9 presents both the unadjusted as well as the medium alternative life expectancy at birth for men and women. The adjustment proves effective in removing crossovers between male and female death rates throughout the projection horizon for all but the very oldest ages.

Figure 6.9 Life expectancy at birth for men and women, with and without discretionary adjustment, registered 2000-2023 and projected 2024-2100[1]



[1] Dashed lines show the medium alternative.
Source: Statistics Norway

Mortality is projected up to and including the year 2100. The projected death rates from the Lee-Carter and ARIMA modelling framework are converted into probabilities and then used as assumptions in Statistics Norway's population projection model, BEFINN. The probability of death varies by sex, one-year age group, and calendar year. We do not consider characteristics such as immigration category, country of birth or duration of stay.

In the future, immigrants will make up a larger share of the Norwegian population, from around 17 percent today to around 22 percent in 2050. Previous studies comparing the mortality rate among immigrants and Norwegian-born children of two immigrant parents with the rest of the population show that, as a broad group, immigrants have a lower mortality rate (Syse et al. 2016, Syse et al 2018). After accounting for the variables included in the BEFINN projection model (age, sex, calendar year and country group), the difference in the mortality rate is around seven to eight percentage points in total. This is a relatively small difference, and the difference also varies with age, duration of stay and country group of origin. While immigrants from Country Group 1, that is, Western Europe, the United States, Canada, Australia, and New Zealand, have approximately the same mortality rate as the rest of the population, the mortality rates in Country Group 2 (new EU countries from Eastern Europe) and Country Group 3 (the rest of the world) are somewhat lower. However, with increased duration of stay in Norway, the mortality rate among immigrants from Country Groups 2 and 3 increases, such that their mortality converges to that of the rest of the population. While comparative studies of the Nordic countries have found immigrants in Denmark, Finland, and Norway to increasingly enhance national life expectancy over recent decades (Wallace et al. 2022), the share of the immigrant population with longer durations of stay is expected to increase in the coming decades (see Chapter 7) and we thus expect to see a gradual narrowing of what are already relatively limited mortality differentials between immigrant and non-immigrant populations in Norway. With this in mind, our projections assume equal mortality rates for immigrants and the rest of the population (i.e., non-immigrants) going forward.

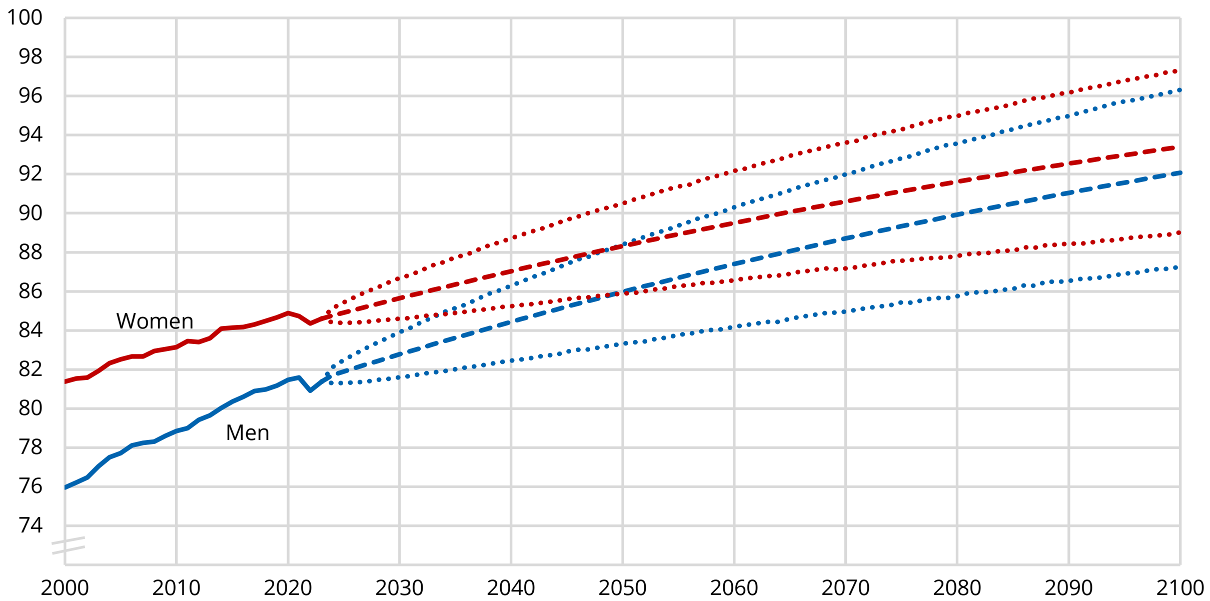
Uncertainty and alternative trajectories

We do not know for sure how mortality will develop in the future and the COVID-19 pandemic clearly demonstrates how there is always a degree of uncertainty, even in the short term. In an attempt to capture this uncertainty, we calculate four alternatives for future mortality. The estimated (adjusted) projection using the ARIMA model is referred to as the medium alternative, around which we specify an 80 percent prediction interval, in line with international recommendations (Savelli and Joslyn 2013). The lower limit in the prediction interval for life expectancy is called the low alternative (low life expectancy), while the upper limit is called the high alternative (high life expectancy). In other words, we consider it 80 percent likely (odds of 4 to 1) that the future life expectancy at birth will be between these limits. In addition, we calculate a constant alternative, where the death rates for the first projected year are kept constant for all subsequent years. To further illustrate uncertainty, this chapter also presents estimates of life expectancy at birth with broader (95 percent) and narrower (67 percent) prediction intervals (Figure 6.11).

6.3. Assumptions about future mortality and life expectancy in this year's projection

Since 1990, life expectancy at birth has increased by 7.9 years for men and 4.8 years for women. In this year's projections, we assume life expectancy will continue to increase. The projections for life expectancy at birth for men and women are shown in Figure 6.10.

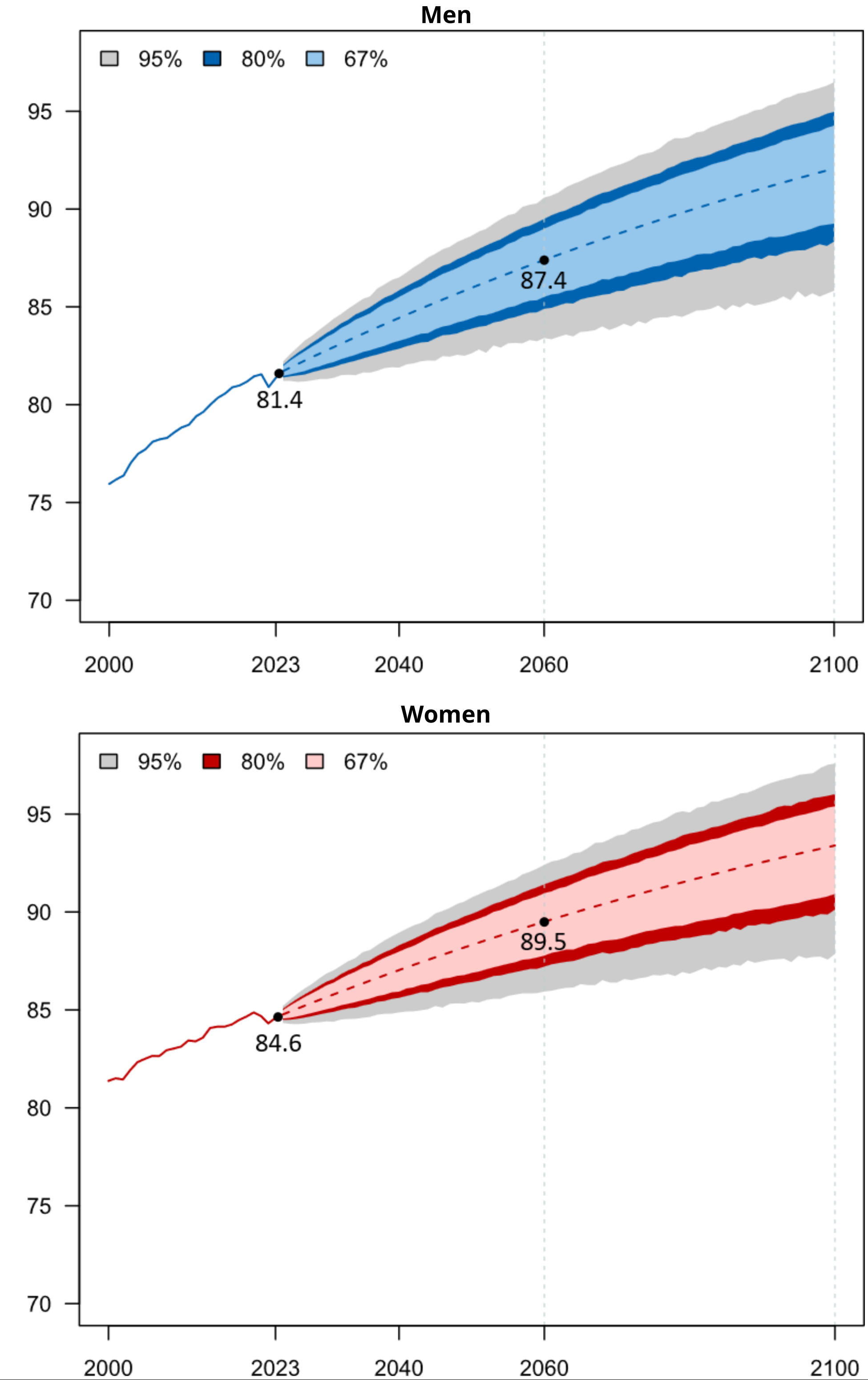
Figure 6.10 Life expectancy at birth for men and women, registered 2000-2023 and projected 2024-2100 in three alternatives[1]



[1] Dashed lines show the medium alternative, dotted lines show the high and low alternatives.
Source: Statistics Norway

In the medium alternative, we have assumed that male life expectancy at birth will increase from 81.4 years in 2023 to 86.0 years in 2050 (i.e., 4.6 years). For women, we expect a somewhat smaller increase, from 84.6 years in 2023 to 88.3 by 2050 (i.e., 3.7 years). Because the trend in mortality is uncertain, we provide alternatives for stronger and weaker developments in life expectancy. In the high alternative, the increase to 2050 is 7.0 years for men (to 88.4 years) and 5.9 years for women (to 90.5 years), whereas in the low alternative we assume a weaker growth of around 2.0 years for men (to 83.3 years) and 1.3 years for women (to 85.9 years) by 2050. As is clear from Figure 6.11, the uncertainty in the projection increases the further forward we move from the projection baseline.

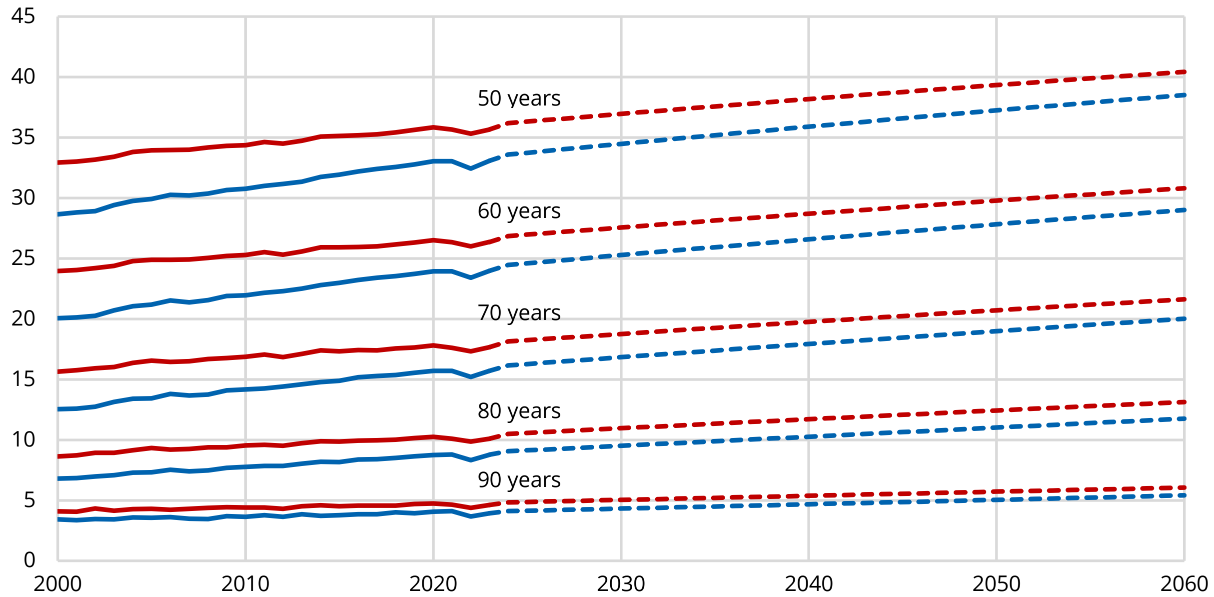
Figure 6.11 Life expectancy at birth for men (blue) and women (red), registered 2000-2023 and projected 2024-2100, medium alternative with prediction intervals[1]



[1] Dashed lines show the medium alternative, while the shaded areas show the 67, 80 and 95 percent prediction intervals (based on 5,000 simulations), respectively.
Source: Statistics Norway

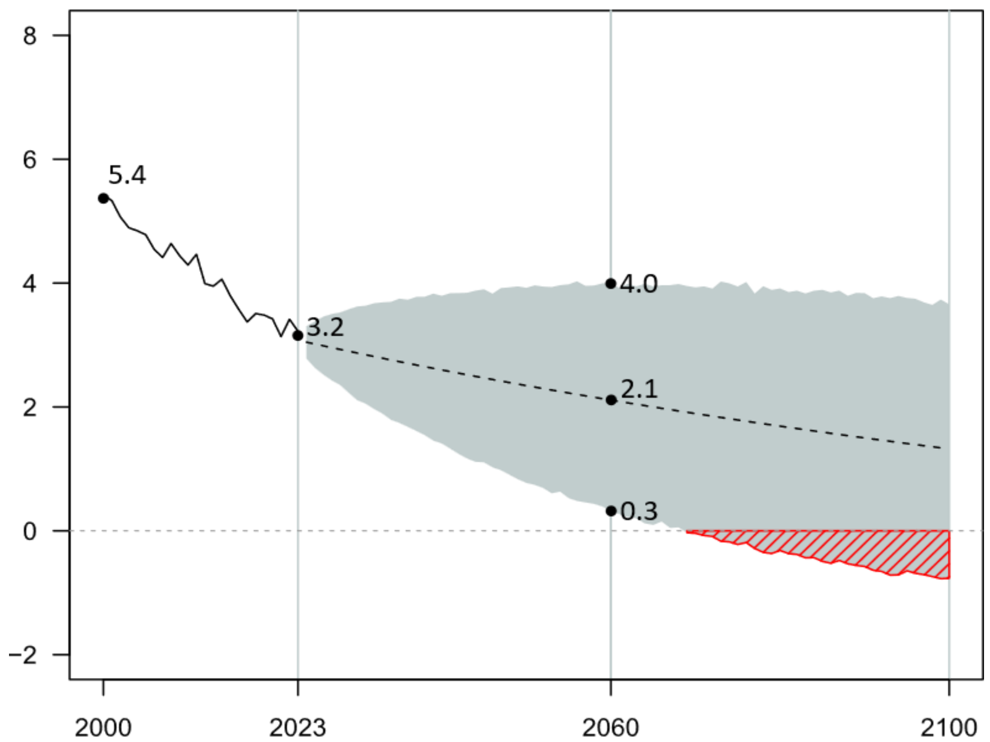
Older age groups are also assumed to see improvements in remaining life expectancy (Figure 6.12), although the size of these improvements weaken as we move up the age distribution. Still, while remaining life expectancy for 90-year-old men was 3.9 years in 2023, by 2050 the medium alternative assumes it will increase to 5.0 years. For 90-year-old women, we assume an increase from 4.6 years to 5.7 years over the same period.

Figure 6.12 Life expectancy at ages 50, 60, 70, 80 and 90, for men (blue) and women (red), registered 2000-2023 and projected 2024-2060, medium alternative



Source: Statistics Norway

Figure 6.13 The difference between male and female life expectancy at birth, registered 2000-2023 and projected 2024-2100[1]



[1] Dashed line shows the medium alternative projection, while the shaded area shows the 80 percent prediction intervals. The area in red is where the difference is negative, suggesting there is a low probability that men will have a higher life expectancy than women in those years.
Source: Statistics Norway

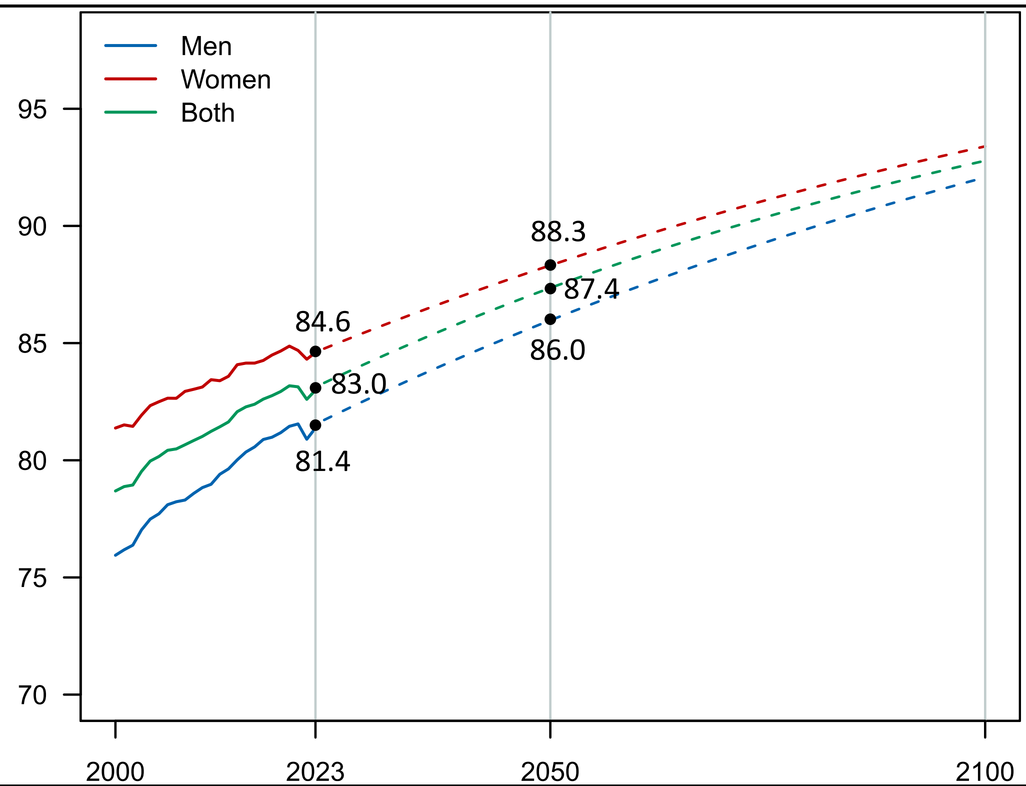
Based on the medium alternative, Figure 6.13 shows the registered and projected difference between male and female life expectancy at birth, with 80 percent prediction intervals indicated by the shaded area. The sex difference in life expectancy at birth is assumed to fall from 3.2 years in 2023 to 2.1 years by 2060 – in line with our discretionary adjustment. The area in red indicates that there is a small chance that men will have a slightly higher life expectancy at birth than women by the 2070s.

6.4. Results from this year's projection

Life expectancy for both sexes combined

Male life expectancy at birth was 81.4 years in 2023, and by 2050 it is expected to increase to 86.0 years according to the medium alternative. For women, we assume an increase from 84.6 years to 88.3 years over the same period. Meanwhile, for both sexes combined, we assume the medium alternative life expectancy at birth to increase from 83.0 years in 2023 to 87.4 years in 2050 (Figure 6.14). For the period 2023-2100, life expectancy at birth and remaining life expectancy for men, women, and both sexes combined are published in Statistics Norway's StatBank (https://www.ssb.no/en/statbank/table/14286).

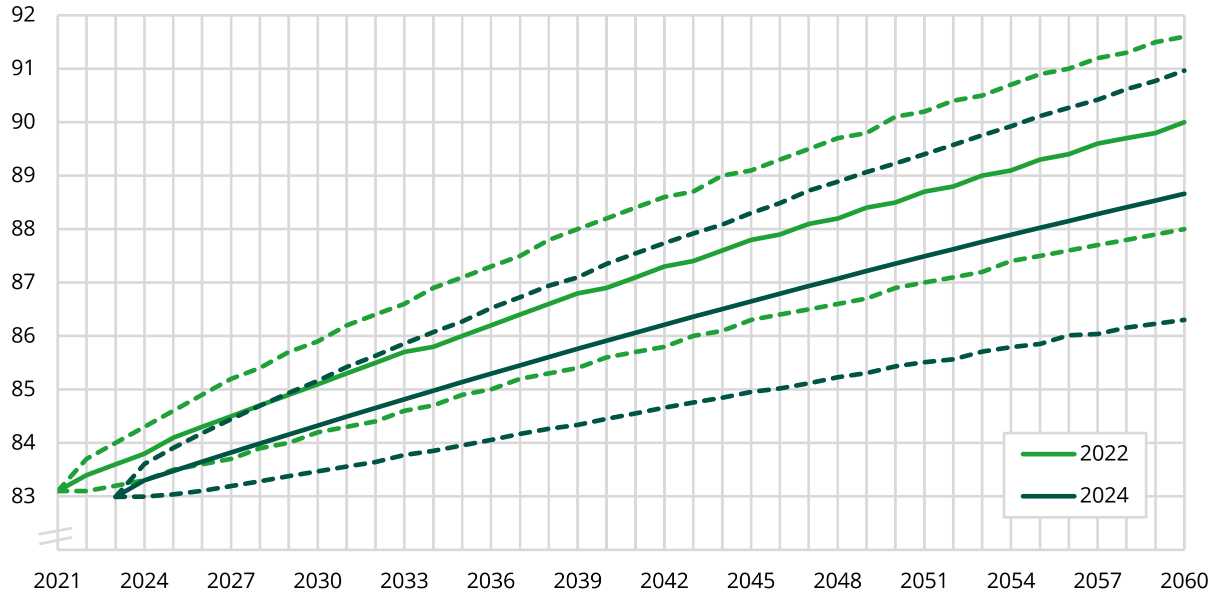
Figure 6.14 Life expectancy at birth for men, women, and both sexes combined, registered 2000-2023 and projected 2024-2100, medium alternative



Source: Statistics Norway

Figure 6.15 provides a comparison of the projected life expectancy at birth for both sexes combined according to the 2024 and 2022 projection rounds. The medium alternative estimate from the 2024 projection is 1.2 years lower than the equivalent estimate from the 2022 projection round. The low alternative estimate in 2050 is 1.5 years lower while the high alternative estimate is 0.9 years lower. More details on comparisons to the 2022 projections can be found in Box 6.3.

Figure 6.15 A comparison of the life expectancy at birth for both sexes combined in the 2022 and 2024 projections in three alternatives, 2021-2060[1]



[1] The solid lines represent the medium life expectancy alternatives, the upper dashed lines show the high life expectancy alternatives, while the lower dashed lines show the low life expectancy alternatives.
Source: Statistics Norway

Future number of deaths

The number of future deaths is determined by population size, age, and sex structure, as well as age- and sex-specific mortality patterns. According to the main alternative (MMM), the number of deaths will increase from 43 800 in 2023 to around 60 000 in 2050, peaking at around 70 000 in 2090. In the low life expectancy alternative (MLM), there will be a stronger increase in the number of deaths, with around 65 000 deaths expected in 2050 and already 70 000 in 2070. In the high life expectancy alternative (MHM), it follows that we have a less significant increase in the number of deaths, with 55 000 expected in 2050, around 60 000 expected in 2060, and around 64 000 in 2080.

The number of deaths will increase in the future because there will be more older people in the population, which is largely driven by the ageing of the large post-war cohorts. Today, the oldest in the population are drawn from the relatively small birth cohorts of the pre-war years. Consequently, the number of deaths will remain relatively low in the short term, but a considerable increase will be observable from the end of the 2020s. The average age at death in Norway will continue to increase in the coming years. According to the medium alternative, the average age at death for men will increase from around 77 years today, to around 84 years by 2050. For women over the same period, average age at death is estimated to increase from around 82 years to 86 years. As discussed in Chapter 1, we can expect older persons to constitute an increasingly significant share of the population, while the age of the very oldest should also increase steadily.

Box. 6.3 Changes from the last projection

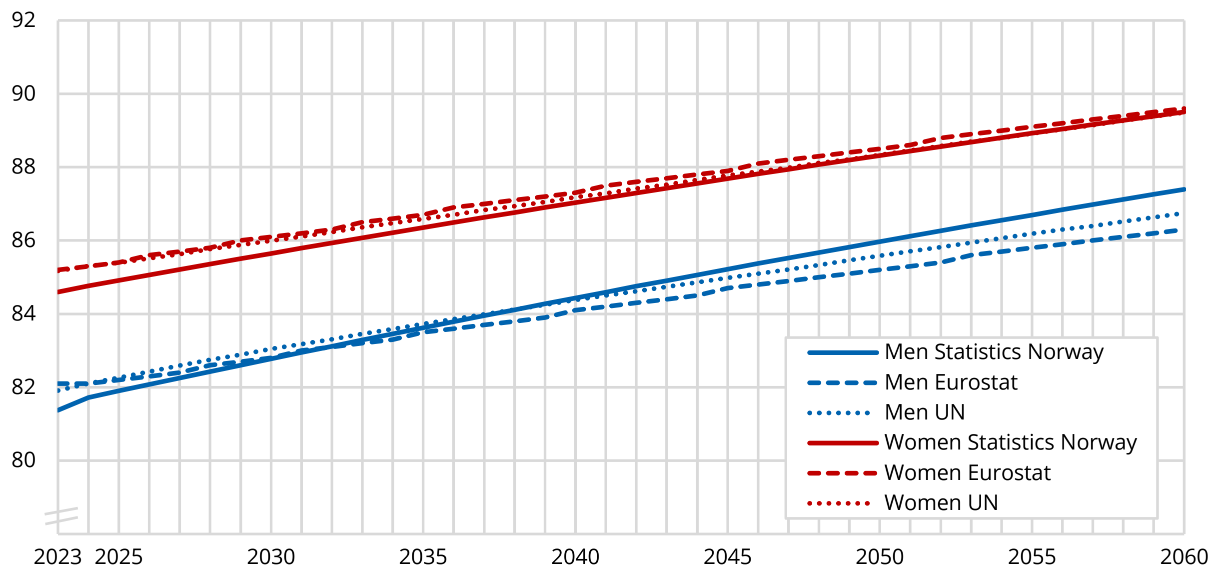
In the medium alternative for the 2022 projections, it was assumed that male life expectancy at birth would increase to around 87.3 years by 2050 and 93.7 years by 2100. The corresponding figures for women were 89.6 and 94.6 years. An evaluation of the accuracy of these estimates in the very short term shows that the 2022 projections overestimated male life expectancy at birth by 0.6 years and female life expectancy at birth by 0.5 years in 2023. This translated into an underestimation of 5 052 deaths by 2024 (3 560 too few in 2022 and 1 492 too few in 2023). While past projection rounds up to 2020 had systematically underestimated short-run life expectancy improvements (Thomas et al. 2022), the 2022 projection appears to have been overly optimistic.

In this year's projections we have assumed a somewhat lower short-term life expectancy for both sexes (around 0.6 years in 2025). By 2040 life expectancy at birth for both sexes combined is around 1 year lower than was projected in 2022, and from 2060 the same estimates are between 1.3-1.4 years lower than those produced in the 2022 projection round. This year's main alternative (MMM) gives a total of about 1 900 more deaths in 2025, around 3 100 more deaths in 2050 and around 2 700 more deaths in 2060 than the main alternative in 2022 projection round.

6.5. Projected life expectancy from alternative producers

Both Eurostat and the United Nations publish their own life expectancy projections for Norway. The United Nations (2022) projections estimated male life expectancy at birth to be 85.6 years in 2050, while the corresponding estimate for women was 88.3 years. The equivalent figures from the Eurostat (2023) projections were 85.2 years and 88.5 years, respectively. Figure 6.16 compares the three projected medium alternative estimates. For both male and female life expectancy at birth, the Statistic Norway projections start from a lower level. This is driven by the fact that the United Nations and Eurostat projections were calibrated on a time series that stopped in 2021, i.e., prior to the reductions in life expectancy observed in 2022, and we are thus projecting from different baselines. For female life expectancy at birth, the three projections assume similar levels, albeit our medium alternative assumes a slightly higher rate of improvement. For male life expectancy at birth, our medium assumption starts lowest but soon surpasses the other two. This is driven by our assumption that male life expectancy will improve at a higher rate than female life expectancy, which is a pattern observed in the historical time series. The United Nations medium variant also assumes a greater relative improvement in life expectancy at birth among men than women, up to around 2040, while Eurostat assumes an equal rate of improvement for the two sexes.

Figure 6.16 A comparison of life expectancy at birth medium alternatives for Norway produced by the United Nations, Eurostat, and Statistics Norway, 2023-2060



Source: United Nations, Eurostat, and Statistics Norway.

We can also compare to the most recent life expectancy projections from the other Nordic countries.[6] The 2024 Swedish population projection projected life expectancy at birth to be 85.3 for men and 87.8 for women in 2050, i.e., 0.7 years lower for men and 0.5 years lower for women than our estimates for Norway. The 2023 Danish population projection projected female life expectancy at birth in 2050 to be the same as our estimate for Norway (at 88.3 years), while male life expectancy at birth in 2050 was estimated to be 0.4 years lower (at 85.6) than our equivalent. At the time of writing, the most recent published projection results for Finland date back to 2021. The 2021 Finnish projection estimated life expectancy at birth to be 85.7 for men and 89.3 for women, which is 0.2 years lower and 0.9 years higher than our estimates for men and women, respectively. The Icelandic 2023 projection for life expectancy at birth in 2050 is lower than all the other Nordic countries, at 82.9 years for men and 87.1 years for women. Thus, this year's projections for Norway assume between a 0.2-year to 0.7-year male life expectancy advantage over Denmark, Finland, and Sweden, while for Iceland we assume a 3.1-year advantage. For women in 2050, we assume an equivalent life expectancy at birth to Denmark, an advantage of between 0.5 to 1.2 years over Sweden and Iceland, while Finland is projected to have a 0.9-year advantage over Norway.

6.6. Summary

Assumptions about mortality and life expectancy are made using statistical models based on developments in mortality observed over recent decades. In this year's projections, we use a time series of registered death rates (for men, women, and both sexes combined) covering the period 2000-2023. Since 1990, life expectancy at birth has increased by 7.9 years for men and 4.8 years for women. By 2050, the medium life expectancy alternative projects life expectancy at birth to increase by a further 4.6 years for men and 3.7 years for women. More specifically, we assume male life expectancy at birth will increase from 81.4 years in 2023, to 86.0 (low 83.3, high 88.4) years in 2050 and 92.1 (low 87.3, high 96.3) years in 2100. For women, an increase from 84.6 years in 2023 to 88.3 (low 85.9, high 90.5) years in 2050, and 93.4 (low 89.0, high 97.3) years in 2100, is assumed. As such, we expect the difference in life expectancy between men and women will reduce over time.

Remaining life expectancy in older age groups will also be characterised by strong increases. According to the medium alternative, remaining life expectancy among 70-year-old men and women is projected to increase by around three years up to 2050. For 80-year-old men and women, remaining life expectancy is expected to increase by more than two years over the same period. The assumed increase in remaining life expectancy in the older age groups will contribute to population ageing. However, the ageing of the population is inevitable because it is already written into the age structure of today's population – even the low life expectancy alternative projects strong population ageing.

[6] Life expectancy by age and sex: Denmark (https://www.statbank.dk/FRDK423); Finland (https://statfin.stat.fi/PxWeb/pxweb/en/StatFin/StatFin__vaenn/statfin_vaenn_pxt_139l.px/); Iceland (https://px.hagstofa.is/pxen/pxweb/en/Ibuar/Ibuar__mannfjoldaspa/MAN09012.px); and Sweden (https://www.scb.se/BE0401-en).

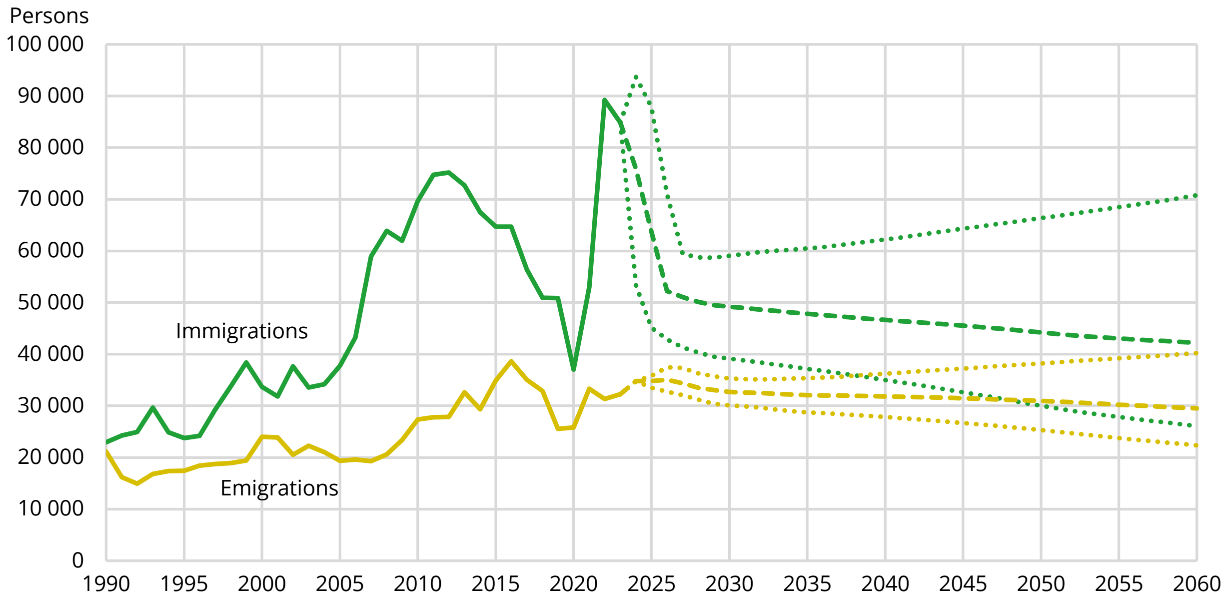
7. International migration – assumptions and results

Ådne Cappelen, Terje Skjerpen, and Michael J. Thomas

In the medium alternative of the national population projections, we assume that gross immigration to Norway will decline from 85 000 in 2023 to 76 000 in 2024 (low 53 000, high 94 000). The short-term projected figures include *ad hoc* adjustments formulated in response to the ongoing war in Ukraine (see Section 7.1), thereafter we assume a sharp decline across all alternatives, before the projections settle on more stable trajectories. In the medium alternative, we assume that gross immigration to Norway will decline somewhat, from around 52 000 in 2026 to around 44 000 by 2050. In the long run, we assume immigration from all country groups will decline, except for a slight increase in re-immigrations of persons with a Norwegian background.

As in the two previous projections, this year's projections account for the age distribution of the sending country groups. Countries in Africa, Asia and other parts of the Global South are expected to experience pronounced population ageing and, because people tend to migrate at younger ages, we assume a much lower level of long-run immigration from these countries than was assumed in projections produced prior to 2020. At the same time, we expect that Norway's economic advantage over the rest of the world will be reduced as Norwegian oil and gas revenues decline. This also works to lower immigration over time. We also expect capital income from the Government Pension Fund Global to fall as a share of national income. The spending of these incomes domestically is likely to have a positive effect on Norwegian GDP. In addition to the medium alternative, we produce low and high immigration alternatives in an attempt to capture the uncertainty in future immigration. As shown in Figure 7.1, our low immigration alternative assumes an even stronger decline, to around 30 000 by 2050, while our high immigration alternative assumes a gradual increase over time, to around 66 000 by 2050.

Figure 7.1 Immigrations and emigrations, registered 1990-2023 and projected 2024-2060 in three alternatives[1]

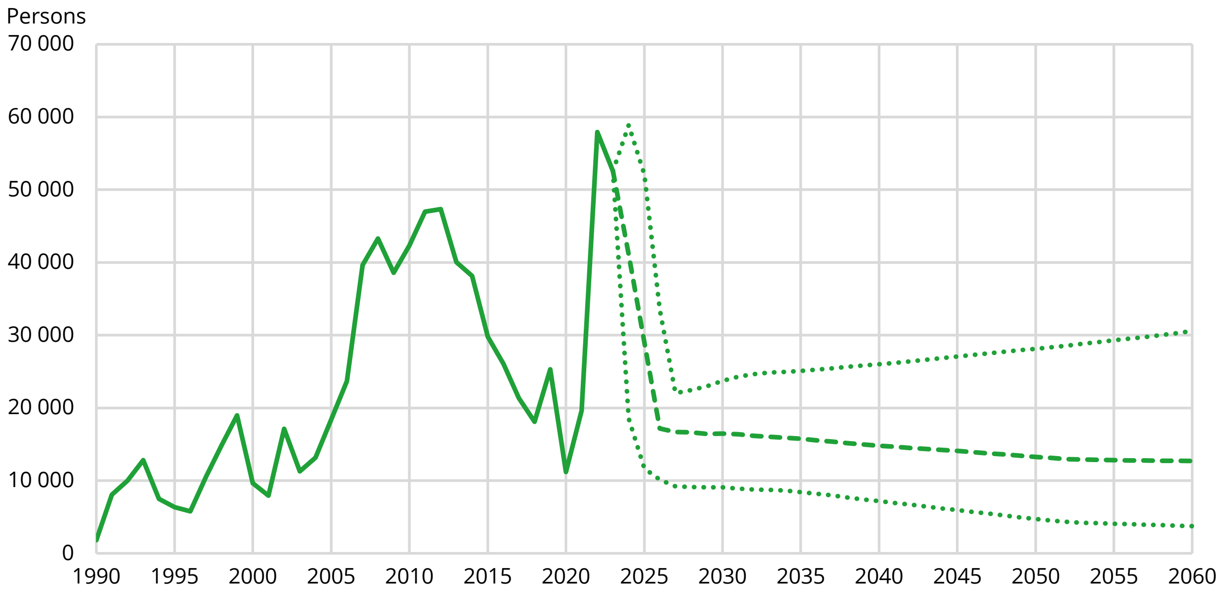


[1] Excludes persons who both immigrate and emigrate during the same year. Alternatives are MMM (main), MMH (high immigration), and MML (low immigration).
Source: Statistics Norway

Future emigration from Norway depends on the number of people in the country and their potential emigration propensities. For instance, immigrants are more likely to emigrate than persons who are born in Norway. In the main alternative, we project relatively stable emigration levels, from around 32 000 in 2023 to around 31 000 per year by 2050 (see Figure 7.1). In the low immigration alternative, we project a more pronounced decline in annual emigration, falling to around 25 000 by 2050. In contrast, around 38 000 are projected to emigrate in 2050 in the high immigration alternative.

Net migration is calculated by subtracting annual emigrations from annual immigrations. Figure 7.2 shows projected net migration in the main alternative, as well as in the low and high immigration alternatives. Net migration remains positive throughout the projection period, although we project a sharp decline from the recent historical highs of 58 000 in 2022 and 53 000 in 2023. In the main alternative, we project a net immigration of around 41 000 in 2024 and around 16 000 in 2030. From 2050 onwards, we assume net immigration to stabilise at around 13 000 per year. In the low immigration alternative, we project a more pronounced decline in net immigration, from around 19 000 in 2024 to around 9 000 in 2030 and around 5 000 in 2050. As a result of short-term *ad hoc* adjustments for Ukrainian arrivals, the high immigration alternative projects an initial increase in net migration to around 59 000 in 2024. By 2050, we assume an annual net immigration of 28 000 in the high alternative. In our main alternative, the number of immigrants in Norway increases from 931 100 in 2024 to more than 1.3 million by 2050, while the number of people born in Norway to two immigrant parents increases from 221 000 to 430 000 over the same period.

Figure 7.2 Net migration, registered 1990–2023 and projected 2024–2060 in three alternatives[1]



[1] The three alternatives are MMM (main), MMH (high immigration), and MML (low immigration).
Source: Statistics Norway

Projecting future immigration and emigration is notoriously difficult due to the many moving parts that work to influence international migration flows. Demographic and economic developments in Norway, as well as the relative changes in such factors across the world, are themselves inherently uncertain. Added to this is the unpredictability of the occurrence, duration, and subsequent effects of such things as wars, conflicts, pandemics, natural disasters, and national and supranational policy changes on future migration flows. As such, uncertainty increases considerably the further into the future we look. Our high and low alternatives attempt to capture this uncertainty by employing alternative assumptions about future population and relative economic development in the rest of the world. As with the 2022 projection round, the ongoing war in Ukraine means that uncertainty, at least in the short-term, is more pronounced in this year's immigration projections than usual.

We discuss the specific assumptions pertaining to the war in Ukraine in the following section. We then discuss historical patterns in Norwegian immigration and emigration, before presenting the methods used to produce our assumptions for future immigration.[7] Finally, we turn to a discussion of the results of the projections, with a particular focus being placed on gross immigration to Norway and resulting implications for changes in the stock of immigrants and Norwegian-born to two immigrant parents.

7.1. The war in Ukraine and potential implications for migration to Norway

At the time of writing (April 2024), approximately six million Ukrainian refugees were recorded across Europe, with approximately half being recorded as living in just three countries, Poland, Germany, and the Russian Federation (UNHCR 2024a). Beyond this, there are 3.7 million internally displaced persons recorded in Ukraine (UNHCR 2024b). Estimates from the International Organization for Migration suggest approximately 4.6 million Ukrainians had returned to their place of habitual residence by 25 September 2023, with 1.1 million of those returning from abroad (IOM 2023). Recent survey results from UNHCR (2024c) suggest that most Ukrainian refugees are planning or hoping to return to Ukraine in the future, but the share has decreased relative to last year (to 65 percent from 77 percent). The share who are undecided about returning has increased from 18 to 24 percent, while the share of those who report no hope to return has risen to 11 percent from five percent (UNHCR 2024c).

With regards to the potential flow of refugees to Norway, the Norwegian Directorate of Immigration (UDI) provides a range of potential scenarios for 2024 (UDI 2024). These scenarios are prepared by UDI in collaboration with the National Police Immigration Service (PU), Landinfo, the Norwegian Directorate for Civil Protection (DSB), the Ministry of Defence, and the Directorate of Integration and Diversity (IMDi). Since January 2024, the scenarios have been updated monthly and are an expression of the working groups' best assessment of publicly available information about the war, the situation in Ukraine, the situation in other European countries, and trends in the number of people seeking protection in Norway at the time. The 2024 national population projections utilise the UDI scenarios to guide our short-term immigration assumptions for Country Group 3, of which Ukraine is a member. More specifically, we utilise UDI's assessment based on the situation as of 9 April 2024 (UDI 2024). This assessment was the most recent version at the time of production of this year's immigration assumptions.

The UDI's medium scenario suggested that approximately 20 000-40 000 Ukrainian refugees could arrive by the end of 2024. However, based on the situation as of 9 April 2024, their assessment was that the number would be closer to the lower end of this interval. Underlying this, UDI (2024) noted the decline over recent months in the number of Ukrainians applying for protection in Europe, despite there being little improvement in the situation in Ukraine. The number of applications in Norway had also been decreasing since October 2023 and the number of applications in the first 13 weeks of 2024 were 44 percent lower than during the same period in 2023 (UDI 2024). The decline in applications to Europe as a whole may indicate a lower preference or ability to leave Ukraine among those who remain. However, in the Norwegian context, the UDI (2024) also noted that the particularly strong decline in applications could reflect the government's adoption of more stringent welfare measures and requirements. Indeed, the number of applications to the other Nordic countries has not followed the same decline as we have witnessed in Norway so far this year. While the UDI does not provide scenarios for arrivals beyond 2024, the consensus among their experts was that the war will be protracted.[8]

As is described in the following sections, our immigration assumptions are formed via an econometric modelling framework that incorporates assumptions about future global population

[7] More details on the formation of the assumption for emigration are given in Section 4.3.
[8] On 7 May 2024, the UDI published an updated medium scenario for the numbers arriving from Ukraine. The medium scenario was down adjusted to 15 000-35 000 arrivals during 2024.

developments and relative economic developments between Norway and three broad country groups. It is not designed to provide specific origin country flows or to project the occurrence of the vast array of potential shocks that might affect immigration in the short or longer term. With this in mind, we have attempted to adjust for the ongoing war in Ukraine by making *ad hoc* adjustments to gross immigration from Country Group 3, of which Ukraine is a member. More specifically, our *ad hoc* assumption in the medium alternative is that an additional 20 000 immigrations will take place from Country Group 3 in 2024, followed by an additional 10 000 in 2025 (30 000 over two years). While the UDI assessment suggests that the current situation is more reflective of lower end of the 20 000-40 000 interval, we limit our adjustment to 20 000 due to the strong decline in applications over recent months and because the numbers must reflect the fact that people cannot immigrate and emigrate in a single calendar year in the projection model (see Chapter 3). Instead, we must provide a net approximation (i.e., subtracting potential return and onward migration) in each year that we make adjustments. The addition of 10 000 immigrations from Country Group 3 in 2025 in the medium alternative reflects an extrapolation of the discussion above. Namely, we follow the assumption that the peak of the refugee flows has passed, that applications are in decline, that Norway is relatively less attractive as a destination than before, but that the war is likely to continue for some time.

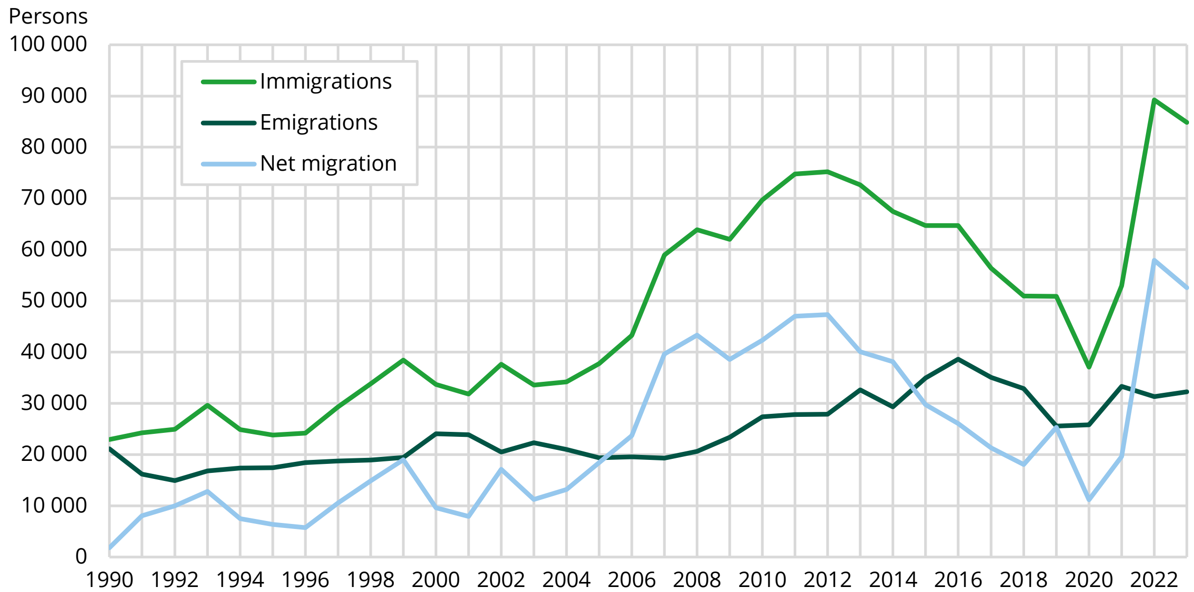
In our low alternative we include an additional 5 000 gross immigrations in 2024, a figure which is based on the approximate number of applications received thus far, while the high alternative includes an additional 30 000 gross immigrations in 2024, followed by 25 000 in 2025, and 10 000 in 2026. Given the 44 percent decline in year-on-year applications thus far this year, we chose to adjust the high alternative in 2024 to the approximate number of recorded arrivals in 2023. In total, up to 2027, the *ad hoc* adjustments to the high alternative include an additional 65 000 immigrations. This total addition represents the same as the total recorded immigration flows from Ukraine observed during 2022 and 2023. The *ad hoc* adjustments to the low, medium, and high alternatives implicitly make assumptions about both the magnitude and duration of refugee flows from Ukraine. Clearly, these assumptions are very uncertain.

Emigration in these situations is also highly uncertain, with the duration of the conflict and legal rights to residence being among a plethora of potential factors worth considering. People fleeing Ukraine to Norway can be granted temporary collective protection for one year at a time, and this can be extended for a period of up to three years, after which authorities must decide on whether to offer permanent residence or not. The scheme for collective protection may be discontinued if Ukraine is deemed to have become a safe country again. Similar schemes were employed in the context of two previous European wars, namely the Bosnian War (1992-95) and the Kosovo War (1998-99). In 1993, approximately 13 000 Bosnian refugees fled to Norway, while in 1999 approximately 7 000 Kosovo refugees fled to Norway. These past examples provide interesting contrasts in the return rates of refugees. In the case of the Bosnian War, conflict and unrest persisted, which resulted in the Norwegian authorities granting amnesty to all refugees who wanted to stay in Norway. In the context of the Kosovo War, hostilities quickly ceased and displaced persons were able to return relatively quickly, with most who had arrived in the summer of 1999 having already returned by the autumn of that year (see Brekke 2001; Brekke 2002). At the time of writing, we have very little information from which to form strong expectations on return rates for Ukrainian refugees. We are now in the third year of the three-year collective protection scheme, but conflict at least in the south and east of Ukraine appears unlikely to end soon. With this in mind, we have relied on the underlying data-driven emigration probabilities for this year's emigration assumption. As such, Ukrainians will follow the same emigration probabilities as other immigrants from Country Group 3 who have the same characteristics by age, sex, and duration of residence. As refugees form a substantial share of arrivals from Country Group 3, we consider these data-driven probabilities to still bear relevance to the Ukrainian context.

7.2. Past trends in immigration and emigration

As is shown in Figure 7.3, immigration to Norway has fluctuated between 37 000 and 89 000 over the past decade. Between the recent peak of 89 000 in 2022, and the last peak in 2011-2012, we witnessed a period of declining immigration. A large share of this decline was driven by the reduction in the number of immigrations from Eastern European Union member states. The negative effect of the travel restrictions associated with the COVID-19 pandemic is also clearly observed in 2020, where annual immigration declined by almost 14 000 compared to 2019. Emigrations from Norway have generally increased over time, which largely reflects the fact that recent immigrants have relatively high emigration rates and thus as the number of recent immigrants increases, so too does the number of emigrations. With that said, typically, around half of registered emigrations are linked to administrative deregistrations. There is thus often a delay between actual emigrations and registered emigrations. The decline in emigrations in 2019 was partly a result of there being unusually few administrative deregistrations in that year (see Box 7.1), while the relatively low level in 2020 again reflects the travel restrictions associated with the COVID-19 pandemic in that year. As travel restrictions and strict global measures affecting economies and societies were relaxed, the number of immigrations and emigrations increased in 2021, to 53 000 and 33 000, respectively. The arrival of more than 30 000 Ukrainian refugees in both 2022 and 2023 underpinned the record level of immigration and net migration observed in those years.

Figure 7.3 Immigration, emigration, and net migration, 1990-2023

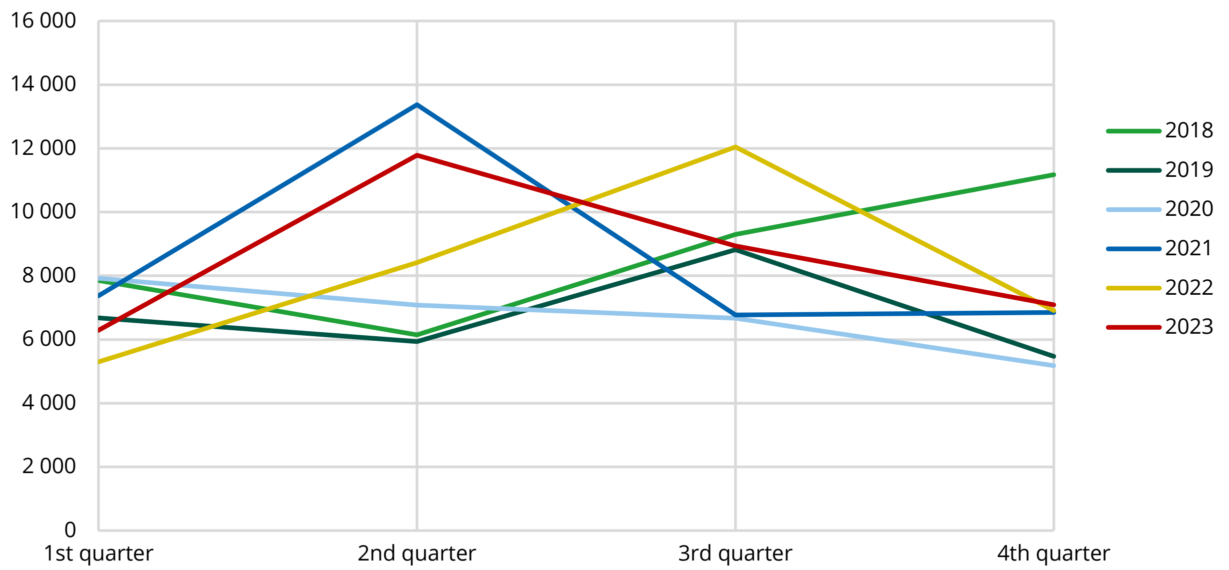


Source: Statistics Norway

Box 7.1 Emigration and administrative deregistrations

In 2019, there was a marked decline in the number of administrative deregistrations of individuals that was a consequence of decisions made by the National Population Register. Typically, administrative deregistrations account for about half of all registered emigrations. If the percentage of deregistrations had been the same as in the previous three years (2016-2018), there would have been just over 5 000 more emigrations and correspondingly fewer residents at the end of the year. This figure pertained primarily to non-Nordic EEA citizens, of whom 1 700 were Poles and 870 Lithuanians. For Norwegian, Nordic, and non-EU citizens, the changes in the percentage of deregistrations were largely within what we consider to be natural fluctuations. Numbers for the first quarter of 2020 returned to a level similar to that in 2018. The effects of COVID-19 restrictions in the remainder of 2020 are visible, with emigration declining with each quarter. The quarterly peaks in 2021-2023 are likely a reflection of administrative deregistrations. A useful discussion and estimation of the scale and composition of unregistered emigration from Norway is provided by Krokedal et al. (2024).

Figure 7.4 Quarterly emigrations from Norway, 2018Q1-2023Q4



Source: Statistics Norway

Fewer immigrations from the typical sending countries

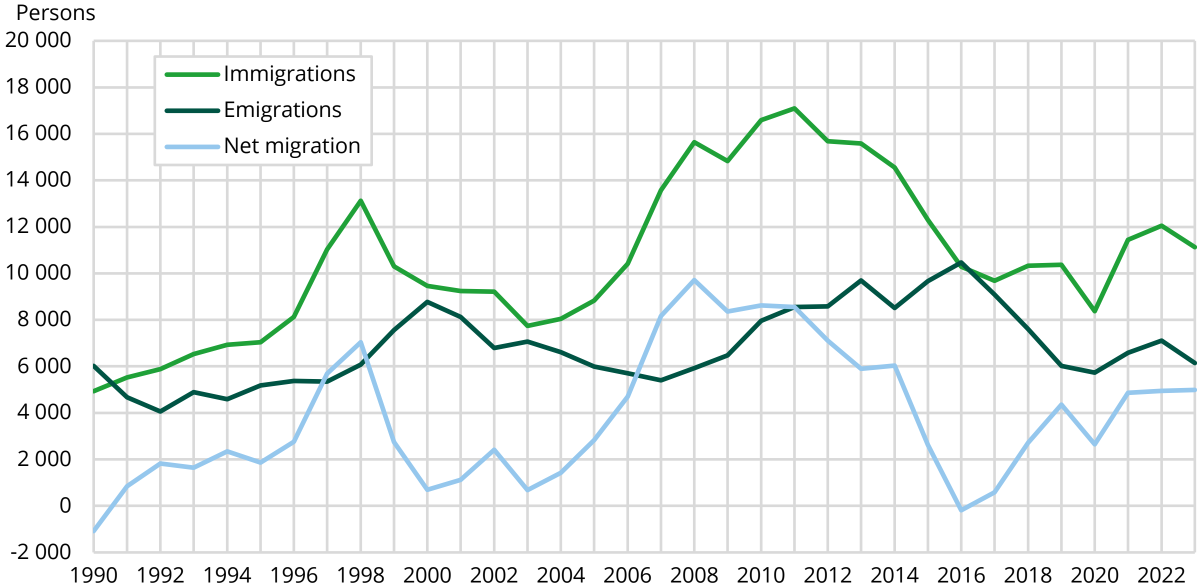
The past decade has seen a reduction in immigration from the most common sending countries, namely, Poland, Sweden, and Lithuania. Annual Polish immigrations have declined from approximately 10 000 in 2013 to 5 000 in 2018. By the end of 2021, immigrations from Poland had increased again to 8 000, which likely reflected a catch-up associated with delayed immigrations during the COVID-19 restrictions in 2020. By 2023, annual immigrations from Poland were down again to around 6 000. Immigrations from Sweden and Lithuania declined between 2011 and 2016, before stabilizing at around 1 500 and 2 500 annual immigrations, respectively. While labour migration from Poland has been the largest source of immigration to Norway over the past decade, refugee flows from Ukraine and Syria have been the second and third most important sources. Immigration from Syria peaked in 2016, at around 11 000. Between 2019-2023 the number of annual immigrations of Syrians has varied between 1 000-3 000. While typically fewer than 500 Ukrainians immigrated annually between 2013 and 2021, more than 60 000 Ukrainian immigrations have occurred since the start of 2022.

Migration by country group

Although it is interesting to know the development in immigration trends from individual countries, our assumptions are made at the country-group level (Box 4.3). We therefore focus our attention on developments in migration by country group.

Figure 7.5 shows the number of annual immigrations, emigrations and net migration associated with Country Group 1 (CG1). According to Figure 7.5, immigrations from CG1 are less common today than in the peak immigration years of 2007-2014. Since 2016, and aside from the sharp COVID-19 related reduction in 2020, immigration has been relatively stable, ranging between 10 000 and 12 000 per year. Emigration, on the other hand, declined markedly after 2016, with net migration having increased as a result. The overall contribution from CG1 has amounted to less than 5 000 net migrations per year since 2014.

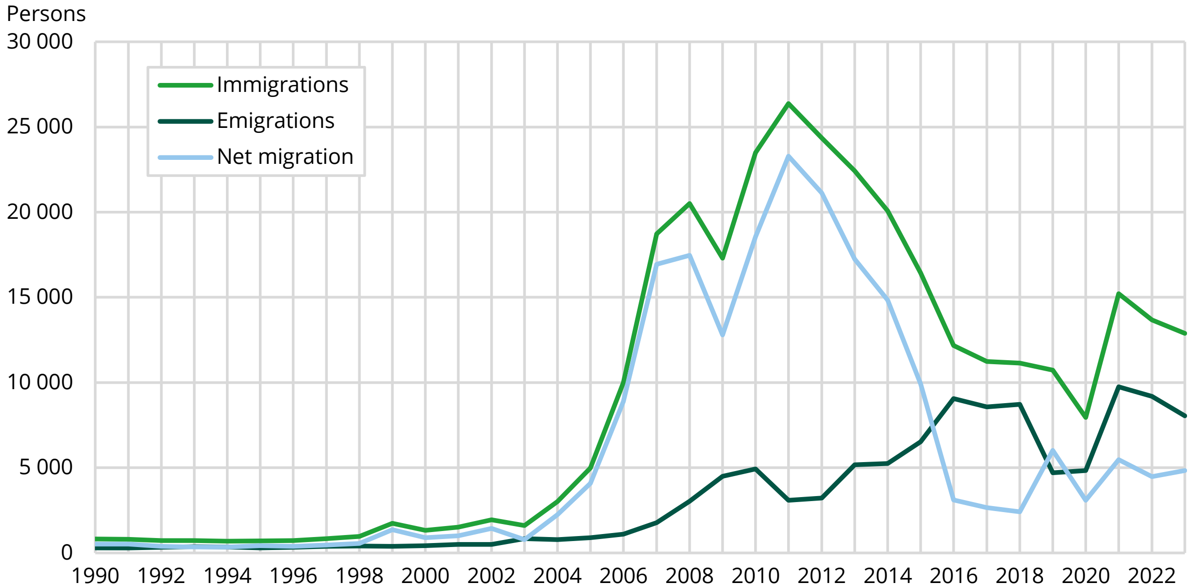
Figure 7.5 Immigrations, emigrations, and net migration for Country Group 1, 1990-2023



Source: Statistics Norway

Figure 7.6 provides the same figures for Country Group 2 (CG2). The effect of EU-enlargements from 2004 onwards are clearly visible in the raised immigration and net migration figures. Between 2011 and 2016, immigration among this group declined, before appearing to stabilize at an annual level slightly above 10 000 up to 2019. The negative effects of COVID-19 on international migration are clear in 2020, with a sharp increase in immigration observed in 2021, which likely reflected a catch-up associated with delayed immigrations during 2020. Figure 7.6 also illustrates the general increase in emigrations from 2011, with a sharp decline observed in 2019 due to fewer administrative deregistrations (Box 7.1). CG2 emigration remained low in 2020, because of COVID-19-related travel restrictions, before rising again in 2021. Net migration during 2017-2018 was down to around 2 500 per year but has since stabilised at around 5 000 annually.

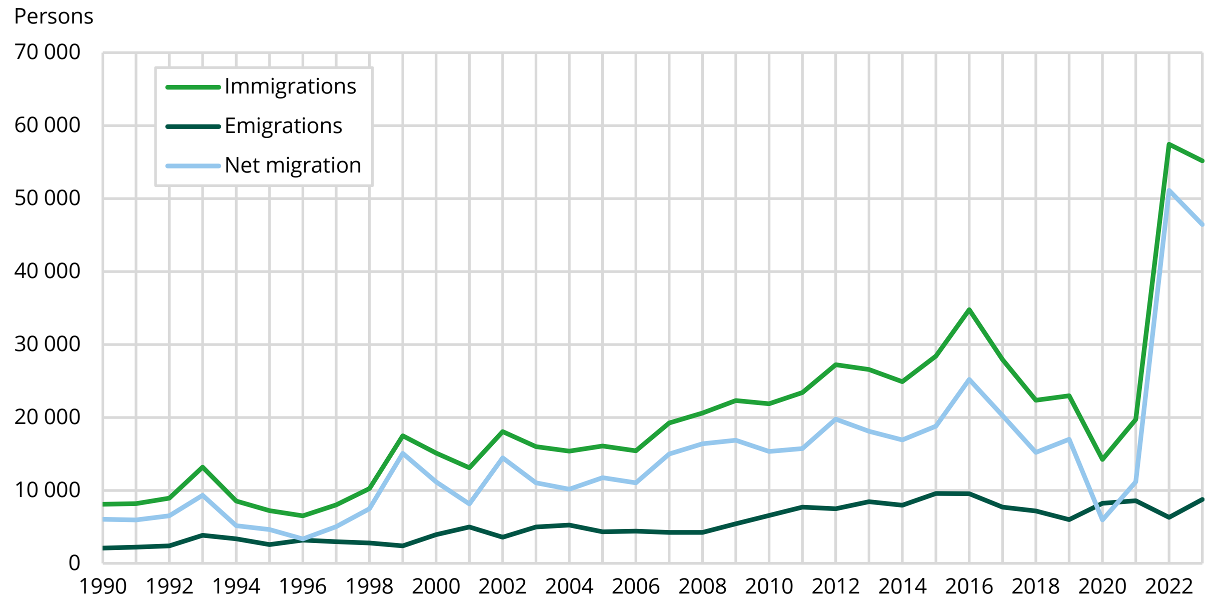
Figure 7.6 Immigrations, emigrations, and net migration for Country Group 2, 1990-2023



Source: Statistics Norway

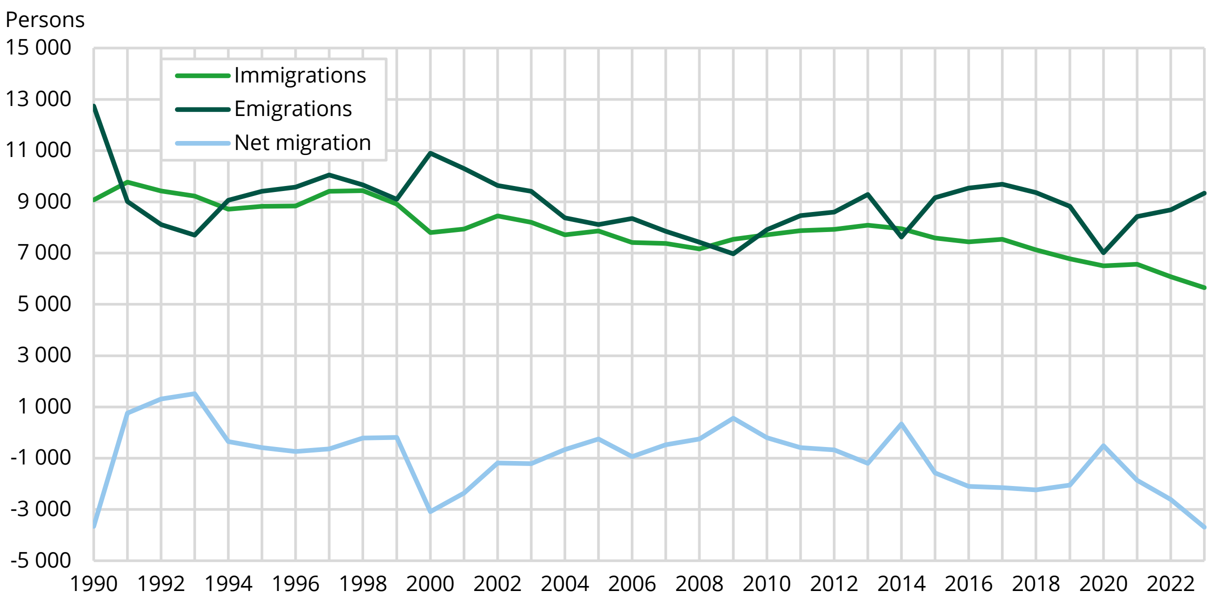
As is show in Figure 7.7, immigration from Country Group 3 (CG3) rose to an initial peak in 2016, at almost 35 000, before declining to around 14 000 in 2020. Following the COVID-19 related travel restrictions in 2020, annual immigration figures for CG3 recovered to approximately 20 000 in 2021. With the onset of arrivals from Ukraine, annual immigrations from CG3 reached record levels in 2022, at around 57 000, declining only slightly in 2023 to 55 000. Relative to the number of immigrations, the number of emigrations from Norway among CG3 is low and, as such, net migration is comparatively higher than for the other country groups. Net migration among CG3 was at or above 15 000 per year between 2007 and 2019. Net migration sharply dropped to around 6 000 in 2020, before rising to 11 000 in 2021. With the arrival of Ukrainian refugees under the collective protection scheme, CG3 net migration increased to 51 000 in 2022 before falling to 46 000 in 2022. For context, the previous peak year for net migration from CG3 was 2016, when net migration reached 25 000.

Figure 7.7 Immigrations, emigrations, and net migration for Country Group 3, 1990-2023



Source: Statistics Norway

Figure 7.8 Immigrations, emigrations, and net migration of non-immigrants, 1990-2023



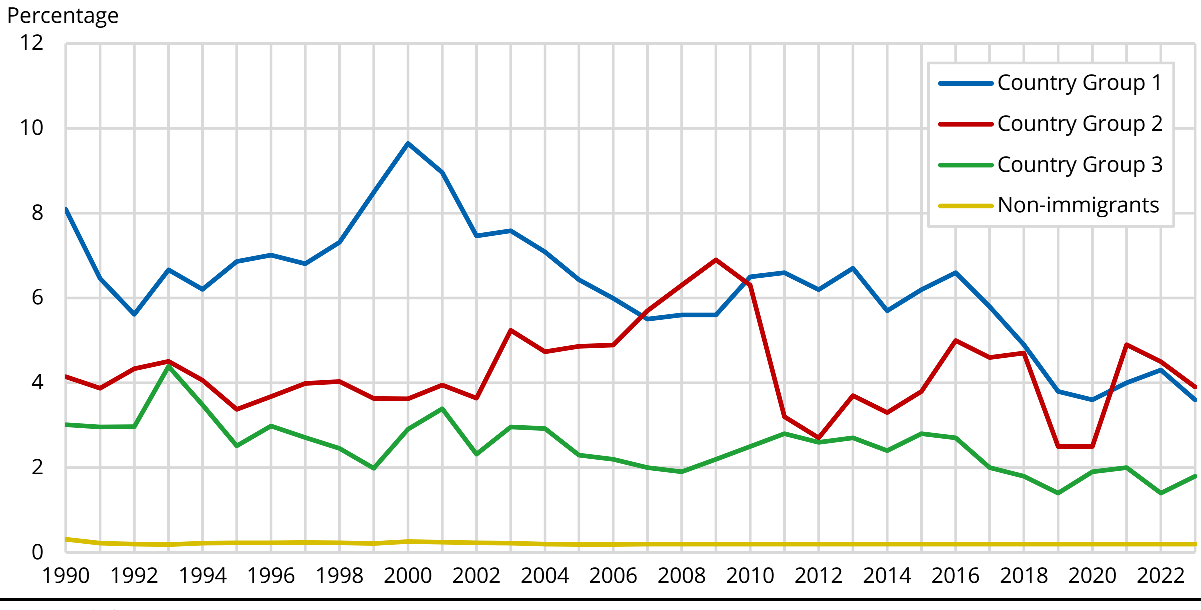
Source: Statistics Norway

Figure 7.8 shows the migration behaviour among the non-immigrant population. This group also includes Norwegian-born to two immigrant parents (see Box 4.4). Emigrations have typically outnumbered immigrations among this group, and thus negative net migration has been the norm.

To summarise, over the last decade, CG3 has contributed most to both immigration and total positive net migration. With that said, prior to the arrival of Ukrainians in 2022, the percentage contribution of CG3 to total immigration had been declining, from over 50 percent in 2016 to 45 percent in 2019 and 37 percent in 2021. Persons from CG1 usually contribute to a positive net migration, although levels have generally been lower than for the other country groups and negative net migration did occur in 2016. CG2 contributed to a marked increase in net migration from the mid-2000s to mid-2010s, but since 2016 immigration levels have generally declined. The contribution of non-immigrants to net migration is relatively minor, although there have typically been more people from the non-immigrant population leaving Norway than entering.

The absolute numbers of emigrations for each country group have been shown in the previous figures, but Figure 7.9 summarises emigrations relative to the stock of persons from the respective country group living in Norway. From this perspective, the likelihood of emigrating is far greater for immigrants than for non-immigrants. It is also clear that the emigration rate for CG3 is relatively low, while persons from CG1 have typically had the highest propensities to emigrate. The only exceptions occurred in 2008-2009 and 2021-2023, when a slightly larger share of immigrants from CG2 were recorded as having emigrated.

Figure 7.9 Emigration rates by country group, 1990-2023



Source: Statistics Norway

7.3. A model for gross immigration to Norway

Statistics Norway makes projections for future immigration to Norway at an aggregate level (Cappelen et al. 2015). In this model, immigration to Norway is largely determined by the following factors, measured at the country-group level:

- Per capita average income in Norway relative to the per capita income of each of the country groups (purchasing power-adjusted gross domestic product (GDP) in nominal value (US dollars) per capita)
- Unemployment rate in Norway and in CG1 and CG2

- Network effects for CG3, i.e., the number of immigrants (from the same country group) who already live in Norway
- Size of the population in broad age groups in the three country groups

Modelling framework

Our modelling approach follows Cappelen and Skjerpen (2014) and the references therein. There are two countries: (o)rigin and (d)estination. The log of wages that an individual living in the origin country would receive if not migrating (w_o) is assumed to be

$$\log(w_o) = \mu_o + \varepsilon_o, \text{ where } \varepsilon_o \sim N(0, \sigma_o^2). \tag{1}$$

Here, μ_0 is the expected wage being determined by observed individual characteristics such as education, sex, etc., whereas ε_0 is a normally distributed stochastic variable with zero mean and a constant variance that captures unobservable characteristics. For individuals who migrate, the wage model in the destination country is similarly

$$\log(w_d) = \mu_d + \varepsilon_d, \text{ where } \varepsilon_d \sim N(0, \sigma_d^2). \tag{2}$$

The error terms are possibly correlated with a correlation coefficient, ρ.

The decision to immigrate or not is determined by the sign of an index, I

$$I = \log\left(w_d / (w_o + c)\right) \approx \left(\mu_d - \mu_o - \delta\right) + \varepsilon_d - \varepsilon_o. \tag{3}$$

Here, c is the level of migration costs (discussed below), whereas δ is the wage equivalent migration cost. Immigration occurs if the value of the index I is positive. Based on our assumptions, the emigration probability, P, for an individual,[9] from the origin country is given by

$$\begin{aligned} P = \Pr\left(I > 0\right) = \Pr\left(\frac{\varepsilon_d - \varepsilon_o}{\sigma_\varepsilon} > \frac{-\left(\mu_d - \mu_o - \delta\right)}{\sigma_\varepsilon}\right) = \\ 1 - \Phi\left(\left(-\mu_d + \mu_o + \delta\right) / \sigma_\varepsilon\right) = \Phi\left(\left(\mu_d - \mu_o - \delta\right) / \sigma_\varepsilon\right). \end{aligned} \tag{4}$$

σ_ε denotes the standard deviation of the difference of the error terms, $\varepsilon = \varepsilon_d - \varepsilon_o$. The term $\frac{\varepsilon_d - \varepsilon_o}{\sigma_\varepsilon}$ is standard normally distributed and Φ is the standard normal cumulative distribution function.

Eq. (4) suggests some hypotheses about migration. First, higher expected income in the origin country lowers P, whereas higher income in the destination country increases P. In addition, the income effects are the same but with opposite signs. We cannot observe expected incomes (μ). Instead, we proxy expected income by using observed incomes and unemployment. We use GDP per capita in a common price set as our measure of incomes. To control for differences between

[9] The empirical counterpart to this probability is the share of persons that have emigrated relative to the population in the origin area, or M/P used in the econometric model later.

measures of income in national currencies and actual purchasing power, we use measures of GDP per capita in nominal purchasing power parities (or PPP for short) in US dollars. Because we only use relative incomes per capita, in line with the theory (Cappelen and Skjerpen 2014), the common price terms cancel out. To capture the income uncertainties that immigrants face, both at home and in the destination country, we include the unemployment rates in addition to the income variables to capture the chance of not getting a job. Thus, an increase in the unemployment rate in the destination country (i.e., Norway in our case) will make it less likely for an immigrant to get a job and earn the income that we proxy with GDP per capita.

Second, the variance of ε is given by

$$\sigma_{\varepsilon}^{2} = \sigma_{d}^{2} + \sigma_{o}^{2} - 2\sigma_{do}. \tag{5}$$

If the destination country has a more equal distribution of income than the origin country, and this would usually be the case when Norway is the destination country, an increase in inequality in the destination country will reduce the standard deviation σ_{ε}.[10] If the term in brackets in Eq. (4) is negative, such that the income in the destination country is higher than in the origin country, after adjusting for migration costs, an increase in destination inequality will increase immigration. Because consistent time series for the Gini-index for many countries are difficult to obtain, we simply neglect the effects of the income distribution effects in what follows.

Third, Eq. (4) also states that higher migration costs relative to income in the destination country will reduce migration. One hypothesis is that migration costs decrease with the number of migrants already settled in the destination country, because these migrants send information about labour and housing markets to friends and family in the origin country and generally provide a network for new entrants. The empirical specification of migration costs is a central part in many econometric analyses of immigration. Standard proxies used are language differences, geographical distance, and migration policy indicators. It is common to include social indicators, accounting for differences in welfare systems, economic development, political stability, and other factors to explain migration flows. These factors are important in explaining the pattern of migration between individual countries but not so important when the purpose is to model variation in immigration to one single country from many origin countries. We simply proxy these factors using the stock of resident immigrants by country as one indicator for migration costs. It is only for CG3 that this proxy is found to be of importance.

Finally, we introduce a set of binary variables to capture the effects of the Norwegian migration policies, regulations that we consider likely to have affected immigration to Norway and events that are affecting migration. We add separate dummy variables, each capturing a policy change, to a standard model of immigration. In some cases, we have introduced impulse dummies to capture specific shocks in the countries of origin. We have also tested if these dummies interact with some of the economic variables discussed above, or if they enter as step dummies for individual country groups that have long lasting effects. In our preferred models, all dummies appear without any interaction with other variables. In contrast to the country results described in Cappelen and Skjerpen (2014), we find effects of these migration policy dummies for CG2, but not for CG1. The enlargement of the EU in 2004 and 2007 meant a permanent institutional change that is captured by step dummies for CG2.

[10] Note that $\partial\sigma_{\varepsilon}/\partial\sigma_{d} = \left(\sigma_{d} - \sigma_{o}\right)/\sigma_{\varepsilon}$ when ε_{d} and ε_{o} are assumed to be perfectly correlated. In the more general case with positive but not perfect correlation, $\partial\sigma_{\varepsilon}/\partial\sigma_{d}$ may still be negative if the correlation is high and the standard deviation is substantially higher for the origin compared to the destination country.

Data
For immigration, the world outside Norway is divided into three country groups of origin, as shown in Box 4.3. In short, the country groups are:

1. Western Europe, the US, Canada, Australia, and New Zealand
2. Eastern EU member countries
3. The rest of the world

Data on immigration to Norway are derived from Statistics Norway's population statistics. If someone moves both to and from Norway (or vice versa) during the same calendar year, this is neither registered as an immigration nor an emigration, since the population projections are based on changes taking place from the turn of one year to the turn of the next. This does not affect the figures for net migration, but both the gross immigration and emigration figures will be a little lower than Statistics Norway's official migration figures. This applies particularly to persons from the EU (i.e., CG1 and CG2), who can move freely between the EU/EFTA/EEA countries.

For economic statistics, we rely on relative income measured by GDP per capita in purchasing power parities (PPPs) and current US dollars, based on information from the World Bank. We use per capita GDP figures in nominal PPP in USD-terms. Because only relative per capita GDP levels are used in the model, the common nominal factor cancels out. We could have used GDP data in real PPP-terms as well, and this would give identical data for relative incomes.

The unemployment rate in Norway is based on the ILO definition and is taken from the labour force survey conducted by Statistics Norway. Similar data for CG1 and CG2 may be found in databases from the OECD and Eurostat We do not include data on unemployment for CG3.

For the emigration rate, GDP per capita, and the unemployment rate, we aggregate individual country data to averages for each group using population shares as weights.

In 2004, several countries joined the EU, with citizens of these countries subsequently gaining free-movement rights to Norway. Some transition rules were put in place (subsequently lifted in 2007 and 2009), but it seems that they had only marginal effects in limiting immigration from these countries. To capture the effects of accession in 2004 we use an indicator variable, *DUM2004*, that takes the value 1 until 2003, 0.33 in 2004 and 0 thereafter. As such, it is expected to affect immigration from these countries positively and permanently. In 2007, changes in regulations were made affecting potential immigrants from EEA countries, as well as immigrants more generally. The new EU members in 2007 (Bulgaria and Romania) were included in the Schengen Area. This is captured by the dummy *DUM2007*. Croatia became a member in July 2013, and we have tried to estimate an effect of this change also using a step dummy that takes the value 1 from 2014 onwards.

Econometric models for the three country groups and three age groups
In this section we present estimations of relations for gross emigration rates to Norway from three country groups, with each country group divided into three age groups. Gross emigration to Norway from a country group equals, of course, gross immigration viewed from the Norwegian perspective. The basic model is based on the discussion relating to Eq. (4). Heuristically, we specified the following model for the emigration rate for each age group and country group:

Emigration rate = F(rel. incomes, unempl. rates, migration costs, policy) (6)

In contrast to what has been the case in the projections undertaken in 2018 and earlier, we use a disaggregated approach when it comes to the age composition of immigrants. We split the population in each country group into three different age groups. Group 1 consists of persons aged

0 to 14 years, group 2 consists of those aged 15 to 39 years and group 3 consists of those aged 40 or older. Thus, the emigration rate, which is the immigration rate to Norway, is disaggregated into three different variables. This is the same age-disaggregation as employed by Skjerpen and Tønnessen (2021). However, we do not have data for incomes, unemployment, and migration costs that are disaggregated by age, so we continue to use aggregated series for these variables in Eq. (6). One motivation behind the disaggregation of the immigration rate is the fact that most migrants tend to be young, typically belonging to age group 2. We also expect future changes in the age composition of the origin countries, with such changes likely to be important when projecting immigration to Norway over the coming decades. According to the United Nations population projections (United Nations 2022), an increasing majority of the population in CG1 and CG2 will consist of people in the oldest age group, an age group with traditionally low migration propensities. Even in CG3, the United Nations (2022) expects the oldest age group (aged 40+) to surpass the age group 15-39 as a share of the total population, and already by the end of this decade. It is reasonable to assume that the immigration rate of the youngest age group (0-14) is linked to the rate of the other two age groups because most child migrants arrive with their parents. Since we use annual data, we encounter a simultaneity issue when estimating the immigration rate of the youngest age group, given its dependence on the migration rate for the other two age groups. This is handled in the modelling approach to which we now turn.

The most common variables used in the models, excluding dummies, are:

M_{ijt} The number of individuals in age group *i* that emigrate to Norway from country group *j* in year *t*.
i=0-14,15-39,40+; *j*=1,2,3.

P_{ijt} The mean population (in 1000s) in age group *i* in country group *j* in year *t*.
i=0-14, 15-39, 40+; *j*=1,2,3.

RY_{jt} Nominal GDP in Norway per capita (in PPPs) in year *t* divided by nominal GDP per capita in country group *j* in year *t*.

U_{kt} The unemployment rate in year *t* measured in percentage terms for country group *k*.
k=NOR,1,2.

$STOCK_t$ The stock of immigrants living in Norway at the start of year *t*.
This variable is used only for CG3.

Country Group 1

Immigrants from CG1 to Norway consist of people from broadly three categories of countries. First, people from the other Nordic countries have had unlimited access to Norway, without even the need of passports, since the late 1950s. Second, we have EU countries, including members of the Schengen Area, that have had unrestricted access to Norway since 1994 (or later). Finally, the group includes people from other OECD countries (the US, Canada, Australia, and New Zealand) that in practice have similar access to Norway. We have estimated three emigration equations for CG1. The emigration rate is defined as migrants to Norway divided by the population in the origin countries for each age group (M/P*).* We have suppressed the country group index for convenience.[11]

[11] To simplify the notation, we do not distinguish between observed and predicted variables, but the left-hand side variables in (7) and (8) should be interpreted as (within-sample) predicted variables.

The estimated equations are (t-values in parentheses are shown below each parameter estimate):

$$\log(M/P_{0\text{-}14})_t = \underset{(-3.50)}{-1.368} + \underset{(5.28)}{0.613}*\log(M/P_{0\text{-}14})_{t-1} + \underset{(6.46)}{0.762}*\log(M/P_{15\text{-}39})_t - \underset{(-4.57)}{0.611}*\log(M/P_{15\text{-}39})_{t-1} + \underset{(2.82)}{0.392}*\log(RY)_{t-1} - \underset{(-1.62)}{0.105}*[\log(U_{nor})_t - \log(U_1)_t]$$

σ = 0.079; $AR_{1\text{-}2}$ = 0.798 (0.46); $ARCH_{1\text{-}1}$ = 0.470 (0.50); Normality = 1.034 (0.60); 1976-2023.

$$\log(M/P_{15\text{-}39})_t = \underset{(-4.80)}{-1.783} + \underset{(6.53)}{0.570}*\log(M/P_{15\text{-}39})_{t-1} + \underset{(4.53)}{0.617}*\log(RY)_t - \underset{(-3.73)}{0.310}*[\log(U_{nor})_t - \log(U_1)_t] - \underset{(-1.05)}{0.139}*[\log(U_{nor})_{t-1} - \log(U_1)_{t-1}] + \underset{(3.14)}{0.253}*[\log(U_{nor})_{t-2} - \log(U_1)_{t-2}] + \text{impulse dummies} \quad (7)$$

σ = 0.069; $AR_{1\text{-}2}$ = 0.523 (0.60); $ARCH_{1\text{-}1}$ = 2.783 (0.10); Normality = 0.344 (0.84); 1976-2023.

$$\log(M/P_{40+})_t = \underset{(-3.95)}{-2.632} + \underset{(5.30)}{0.566}*\log(M/P_{40+})_{t-1} + \underset{(3.07)}{0.464}*\log(RY)_t - \underset{(-5.41)}{0.452}*\log(U_{nor})_t + \underset{(3.59)}{0.293}*\log(U_{nor})_{t-2} + \underset{(4.92)}{0.857}*\log(U_1)_{t-1} - \underset{(-4.16)}{0.667}*\log(U_1)_{t-2} + \text{impulse dummies}$$

σ = 0.101; $AR_{1\text{-}2}$ = 0.288 (0.75); $ARCH_{1\text{-}1}$ = 0.664 (0.42); Normality = 1.160 (0.56); 1976-2023.

The estimated equations in (7) have been chosen based on a predesigned set of criteria. We do not accept models where variables enter with the wrong sign neither in the short nor the long run. The estimated residuals should be Gaussian, i.e., have zero expectation, not be autocorrelated nor heteroscedastic. The autocorrelation test (AR) and test for homoscedasticity (ARCH) are both F-tests while the normality test is a Chi-square test. P-values are shown in parentheses after the values of the test statistics. The estimated standard error of regression is given by σ. All the equations above satisfy these predesigned criteria. The first equation is initially estimated using instrument variables (IV) because the immigration rate of children depends on the immigration rate of 'parents', who are members of the other two age groups. The instruments used are lagged values of the variables entering the equation for $M/P_{15\text{-}39}$. However, the estimates using ordinary least squares (OLS) and IV are so similar that only the OLS estimates are shown. The two last equations are estimated using OLS. The chosen models have quite stable parameter estimates during the last 20 years according to recursive estimation results.[12] The models have initially been formulated as so-called equilibrium correction models but transformed to a standard autoregressive distributed lag (ADL) form which we employ for forecasting.[13]

Looking at the first equation in (7) we should note that the emigration rate for 'parents' ($M/P_{15\text{-}39}$) enters twice both with and without a lag. In the long run the emigration rate for children increases by 0.39 percent when the 'parent' emigration rate increases by one percent, and by 1.01 percent when per capita income in Norway increases relative to that in CG1. These results are very similar to those two years ago. For the second age group, the emigration rate for 15-39 years old increases by 1.43 percent when relative incomes in Norway increase by one percent. This result is also very close to what we had two years ago. An increase in the unemployment rate in Norway from 4 to 5 percent lowers the long-run emigration rate by 11 percent. A similar increase in the unemployment rate in CG1 increases the emigration rate by 11 percent because of the imposed symmetric response. From a purely statistical point of view, this is not rejected by data. This effect is somewhat higher than we

[12] Details are available upon request.
[13] For a discussion of possible cointegration between the variables included in the equations for Country Group 1, see Cappelen and Eika (2020).

had two years ago. However, as long as we assume that relative unemployment levels are constant, and this is what we assume now and what we also did two years ago, this difference in estimation results has no effect in the long run. The equation for the oldest age group has a long-run income effect of 1.07 percent, which is a bit lower than previous estimates. The unemployment effects are less restricted than earlier. An increase in the unemployment rate from 4 to 5 percent in Norway will reduce the emigration rate and thus immigration level to Norway by 9 percent, while a similar increase in the unemployment rate in CG1 increases immigration to Norway by 7 percent. The equations in (7) include dummies for 2020 and 2021, to capture COVID-19 effects, except for the youngest groups where these dummies are present implicitly through the role of the 'parent' effect. The policy changes that increased the potential for migration when Norway became member of the EEA or Schengen Area have not resulted in any significant effects. This is probably due to the aggregate nature of this country group, that consists of Nordic countries where there have been no policy changes, the original EU countries where changes have occurred, and the US and Canada where these policy changes probably have not had much effect, see Cappelen and Skjerpen (2014).

Country Group 2

This group consists mostly of eastern European countries that changed their economic and political system from around 1989 onwards. For CG2 our sample starts in 1990. Initially, it was difficult for citizens of these countries to move to countries in Western Europe, except when employed in seasonal work. However, when a number of these countries became members of the EU, starting in May 2004, the restrictions on migration were gradually lifted. When formulating our forecasting equations, we have included a step-dummy that has the value of one up to 2003, 0.33 for 2004 (as the change took place in May) and 0 after that. Because our models are specified in logarithms it implies that the percentage changes are unaffected by the policy change in 2004, but since there is a positive shift in the intercept the absolute effects of changes in the explanatory variables become much larger. We also need to include some impulse dummies to achieve a reasonably stable model. The estimated equations are (t-values are shown below each parameter estimate):

$$\log(M/P_{0\text{-}14})_t = \underset{(-14.70)}{-1.319} + \underset{(9.68)}{0.379}*\log(M/P_{0\text{-}14})_{t-1} + \underset{(18.0)}{0.738}*\log(M/P_{15\text{-}39})_t + \underset{(8.65)}{0.859}*\log(RY)_t + \text{step and impulse dummies}$$

σ = 0.073; $AR_{1\text{-}2}$ = 0.426 (0.66); ARCH $_{1\text{-}1}$ = 0.128 (0.72); Normality = 3.4950 (0.17); 1994-2023.

$$\log(M/P_{15\text{-}39})_t = \underset{(-0.54)}{-0.189} + \underset{(1.78)}{0.269}*\log(M/P_{15\text{-}39})_{t-1} + \underset{(2.80)}{0.370}*\log(M/P_{15\text{-}39})_{t-2} - \underset{(-4.11)}{0.717}*\log(U_{nor})_t + \underset{(2.99)}{1.346}*\log(RY_{,t-2}/RY_{,t-3}) + \underset{(3.28)}{0.807}*\log(RY)_{t-2} + \text{step and impulse dummies} \quad (8)$$

σ = 0.151; $AR_{1\text{-}2}$ = 2.882 (0.08); ARCH $_{1\text{-}1}$ = 0.064 (0.43); Normality = 1.080 (0.58); 1992-2023.

$$\log(M/P_{40+})_t = \underset{(-3.62)}{-1.055} + \underset{(7.86)}{0.467}*\log(M/P_{40+})_{t-1} - \underset{(-5.70)}{0.923}*\log(U_{nor})_t + \underset{(4.07)}{0.404}*\log(U_2)_t + \text{impulse and step dummies}$$

σ = 0.169; $AR_{1\text{-}2}$ = 0.618 (0.55); ARCH $_{1\text{-}1}$ = 0.981 (0.33); Normality = 0.381 (0.83); 1991-2023.

For the youngest age groups in CG2, the 'parent' effect is 1.2 in the long run. There are no effects of unemployment, but the long-run effect of relative incomes is large and in line with previous results. For the age group 15-39 years, the long-run income effect is 2.2, showing that this age group is highly mobile across borders if relative incomes change. There is also a very large, long-run response to changes in the Norwegian unemployment rate, but no effect of unemployment in the origin country group. An increase in the Norwegian unemployment rate from 4 to 5 percentage points will, in the long run, reduce the immigration level by 50 percent. This is the same as previous estimates. For the oldest age group, the income effect is 1.2 and the unemployment effect is - 0.9. Both effects are smaller than for the 15-39 age group, but still quite large. Note that the unemployment rate in CG2 has no long-run effect on migration to Norway according to these estimates. It is only the Norwegian unemployment rate that matters. This is very different compared to what we found for CG1. For the oldest age group, only unemployment rates in Norway and in Country Group 2 have been found to be significant, whereas relative incomes do not matter for this group anymore. This is a change compared to our previous estimates but not surprising given the fairly low degree of significance we had in the model used in 2022.

Country Group 3

The immigrants from CG3 consist of persons that emigrate to Norway for different reasons. Economic incentives represent only one factor affecting the emigrations from CG3. Indeed, over the period 2012 to 2022, a considerable share of annual immigrations from this group were refugees (between 25 percent to 50 percent) and family migrants (between 35 percent to 50 percent). Education-related migrants have typically comprised around 15 percent of annual immigrations from CG3, while labour migrants have ranged from between 5 percent and 15 percent per year. As a result of the war in Ukraine, the number of refugees arriving from CG3 increased dramatically in 2022 and 2023.

Compared to most immigrants coming from CG1 and CG2, persons from CG3 that wish to settle in Norway are faced with a comprehensive juridical evaluation before eventual settlement is allowed. Immigration from CG3 is impacted by factors both on the supply and the demand side. The supply side is influenced by economic incentives, but also by the needs of persons in CG3 to find a safe place when confronted with conflicts, acts of war, and persecution. The demand side is constituted by Norwegian authorities, but also by Norwegian firms in need of skilled workers. In the econometric model presented below, we mainly account for factors on the supply side. When it comes to the estimation of the model used for projection, we include some impulse dummies to capture marked changes in immigration, accounting for the effects of certain shocks that cannot be explained by the other variables included in the model.[14] We might also expect shocks during the projection period. The size and sign of future shocks are very difficult to predict. The same is true for their timing and effects. Furthermore, it is also hard to foresee what the response of Norwegian authorities will be to any such occurrences. For instance, with respect to the high immigration alternative outlined below, the government could choose to tighten regulations on immigration in response to positive supply shocks relating to a potentially large influx of immigrants from CG3. We have removed immigrations of Ukrainians from immigration from CG3 when estimating the model for CG3. The path for immigration from Ukraine to Norway in the years 2024-2100 is given exogenously via the *ad hoc* adjustments described in Section 7.1.

The econometric model for CG3 is a system of three regression equations (one for each age group). The endogenous variables are the three (log-transformed) emigration intensities.[15] We expect the income ratio variable, (RY), and the stock variable, log($STOCK_t$), to enter with positive effects.[16] The same is true for the two dummies, i.e., $DUM1999_t$ and $DUM2016_t$, as they both pick up high immigration in a single year. We have also included a third impulse dummy, $DUM2020_t$, related to

[14] $DUM1999_t$ - An impulse dummy being 1 in 1999 and 0 in all other years. It is related to a large influx of immigrants from the Balkans in 1999.
$DUM2016_t$ - An impulse dummy being 1 in 2016 and 0 in all other years. It is related to a large influx of immigrants from Syria in 2016.
[15] That is, immigration from CG3 without Ukraine divided by the mean population in CG3 without Ukraine.
[16] Note that the stock variable is measured at the start of the period. Note that the stock variable is measured at the start of the period. While immigrations from Ukraine have been removed from the modelled variables in (8), immigrants from Ukraine are included in the stock variable.

COVID-19. It is expected to appear with a negative effect since the pandemic contributed to a reduction in immigration. The two unemployment variables, i.e., $\log(U_{nor})$ and the change in this variable, are expected to have a negative effect on emigration. The three errors in the system are assumed to be distributed according to a trivariate normal distribution, where the expectations are zero and where the covariance matrix of the contemporaneous error terms is full and positive definite. The estimated equations are (t-values are shown in parentheses below each parameter estimate, while $e3\_0\text{-}14_t$, $e3\_15\text{-}39_t$, and $e3\_40+_t$ denote residuals in the equations):

$$\underset{}{\log(M/P_{0-14})_t} = \underset{(-122)}{-5.032} + 0.474*\log(M/P_{0-14})_{t-1} + 0.317*\log(RY)_{t-2} + 0.095*\log(STOCK)_t + \underset{(2.55)}{0.582}*DUM1999_t + \underset{(2.27)}{0.516}*DUM2016_t - \underset{(-3.23)}{0.482}*DUM2020_t + e3\_0\text{-}14_t$$

$\sigma = 0.224$; 1992-2023.

$$\log(M/P_{15-39})_t = \underset{(-43.7)}{-4.062} + 0.474*\log(M/P_{15-39})_{t-1} + 0.317*\log(RY)_{t-2} + 0.095*\log(STOCK)_t - \underset{(-5.69)}{0.350}*\log(Unor)_{t-1} + \underset{(1.19)}{0.189}*DUM1999_t + \underset{(2.48)}{0.393}*DUM2016_t - \underset{(-3.23)}{0.482}*DUM2020_t + e3\_15\text{-}39_t \quad (9)$$

$\sigma = 0.155$; 1992-2023.

$$\log(M/P_{40+})_t = \underset{(-135)}{-5.229} + 0.474*\log(M/P_{15-39})_{t-1} + 0.317*\log(RY)_{t-2} + 0.095*\log(STOCK)_t - \underset{(-1.81)}{0.348}*\log(U_{nor,t-1}/U_{nor,t-2}) + \underset{(1.51)}{0.326}*DUM1999_t + \underset{(1.34)}{0.289}*DUM2016_t - \underset{(-3.23)}{0.482}*DUM2020_t + e3\_40+_t$$

$\sigma = 0.210$; 1992-2023.

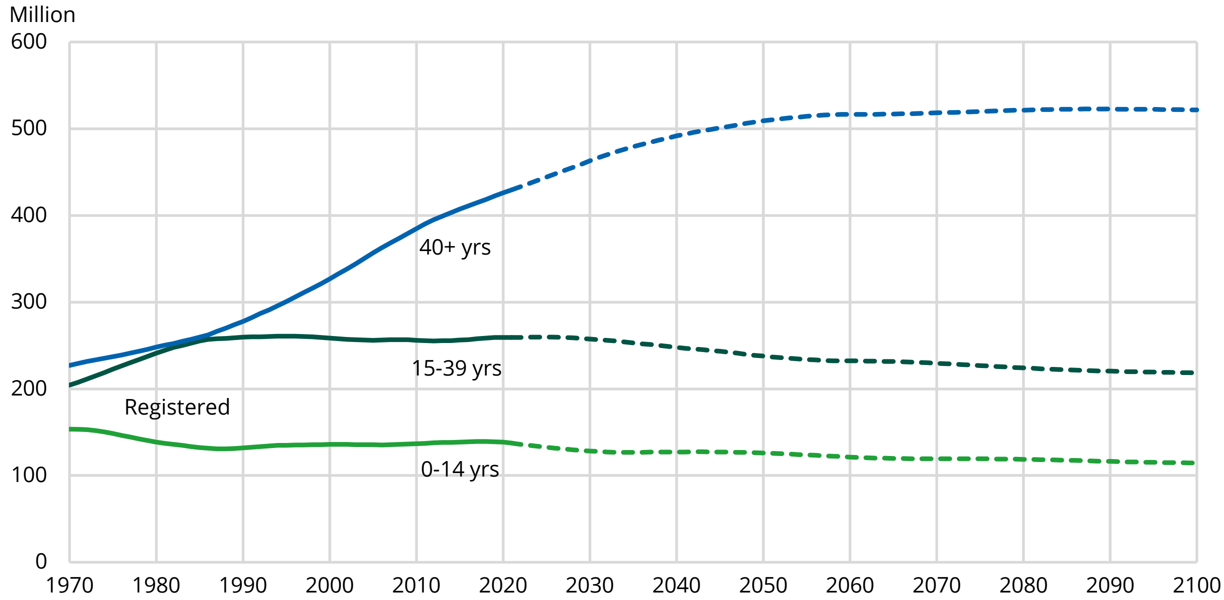
For the iterations to converge also in the high alternative, it has been necessary to monitor some of the parameters. We have set the income effect equal to a common value, 0.317, which is the same as the one used for the aggregate approach in the 2018 projections. The size of the parameter of the network variable is important when it comes to convergence. If it is too high, one encounters convergence problems in the high alternative. We have calibrated it such that it is one third of the size of the coefficient of the income ratio variable. The derived value is thus 0.095. Neither the parameters of the lagged endogenous variables (one for each age group) should be too high. We have set them to a common value of 0.474, which is the same value that was employed in conjunction with the official projections in 2018. An alternative procedure would have been to allow for age-group-specific responses related to the three right-hand side variables mentioned above. However, it is hard to know *a priori* how one should rank the groups with respect to the size of different parameters for the right-hand side variables. Thus, we have chosen a simple and practical solution. Conditional on the values of the three calibrated parameters, we have estimated the remaining parameters by full information maximum likelihood (FIML). In all three equations we have estimated the effects of the three impulse dummies. We have imposed the (valid) constraint that $DUM2020_t$ enters the three equations with the same parameter. For two of the age groups, the estimated effect of the Norwegian unemployment rate is negative. However, one should note that for the age group 15-39 it is the lagged (log) unemployment rate that enters the equation, whereas for the age group 40+ years it is the lagged relative change in the unemployment rate that enters the equation. The derived value of the long-run relative income effect is 0.6, which is much smaller than for the other country groups.

Forecasts of the variables

Once the parameters have been estimated (or calibrated) for each of the nine equations, they are used to calculate future immigration to Norway. To be able to do this, we need forecasts of how the economic and demographic variables will develop over the projection period (the explanatory or forcing variables).

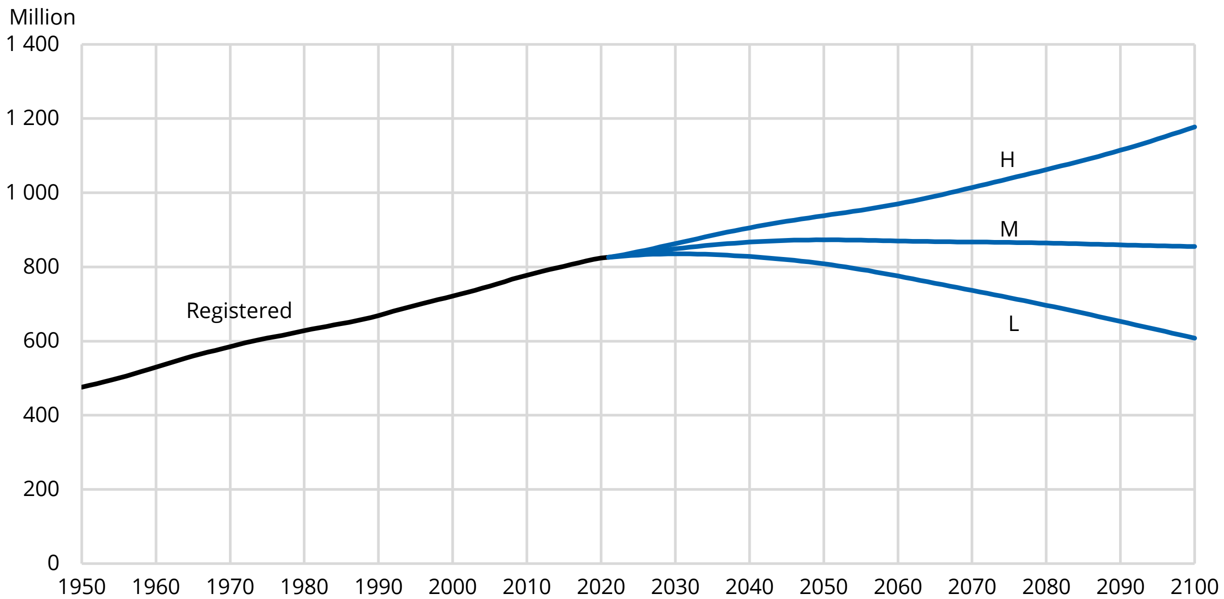
The figures for the future development of the population in the three country groups are taken from the most recent United Nations population projections (United Nations 2022). In our medium alternative, we use the United Nations medium variant. In our high and low alternatives, we use United Nations high- and low-fertility variants, respectively.

Figure 7.10 Population in Country Group 1 in three age groups, registered 1970–2021 and projected 2022-2100 by the United Nations, medium variant



Source: United Nations

Figure 7.11 Total population in Country Group 1, registered 1950–2021 and projected 2022-2100 by the United Nations in three alternatives[1]

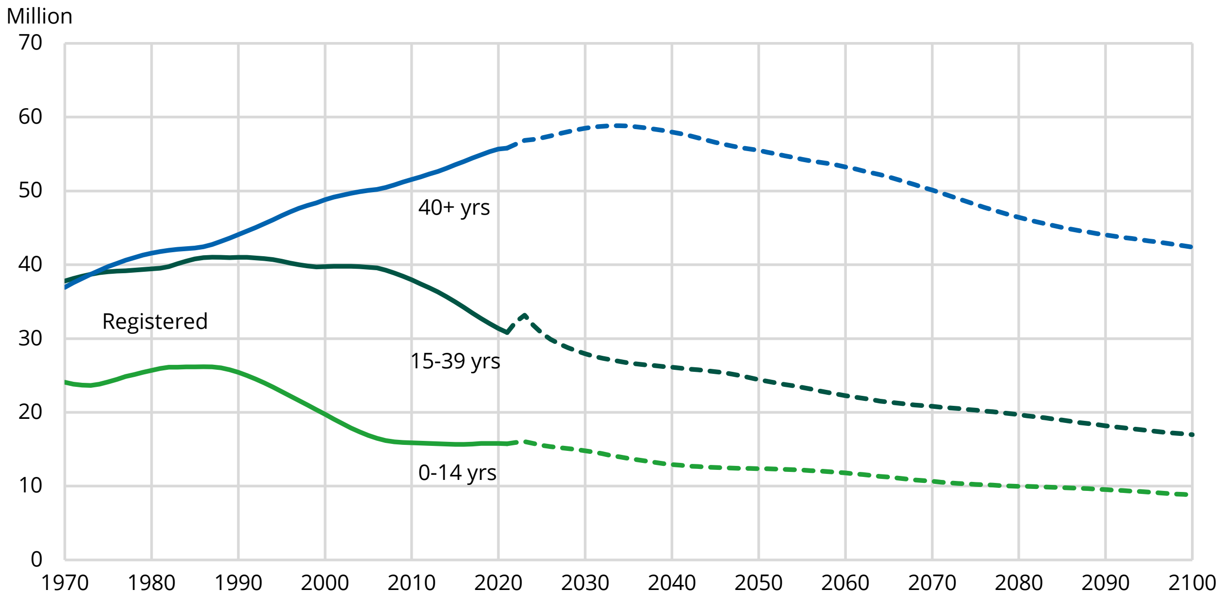


[1] The alternatives are medium variant (M), low-fertility variant (L), and high-fertility variant (H).
Source: United Nations

Figure 7.10 depicts the projected change in the age distribution for CG1. While the number of children in CG1 has been approximately constant at between 130-140 million from the early 1980s, the number of people aged 40+ years has been increasing and is expected to reach 500 million during the 2040s. Meanwhile, the most mobile age group, 15-39, is expected to gradually decline in size, from around 260 million people today, to around 240 million by 2050 and 220 million by 2100. The three alternative developments of the total population in CG1 are given in Figure 7.11. As can be seen from the figure, there is marked uncertainty as to whether the total population will remain broadly stable, decline, or increase.

Figure 7.12 presents historical and projected age distribution for CG2. We see that the number of people in the most mobile age groups started to decline in the period after which most of these countries became EU-members. This is to some extent a result of the fact that many people in this age group emigrated to Northern and Western European countries, including Norway. The decline in the size of the youngest age group took place earlier, when fertility levels dropped sharply in the period following the collapse of the Soviet Union. It is expected that the population aged 0-14 and 15-39 will continue to decline from this point on. For the oldest age group, limited growth is expected into the 2030s, before it too enters a decline.

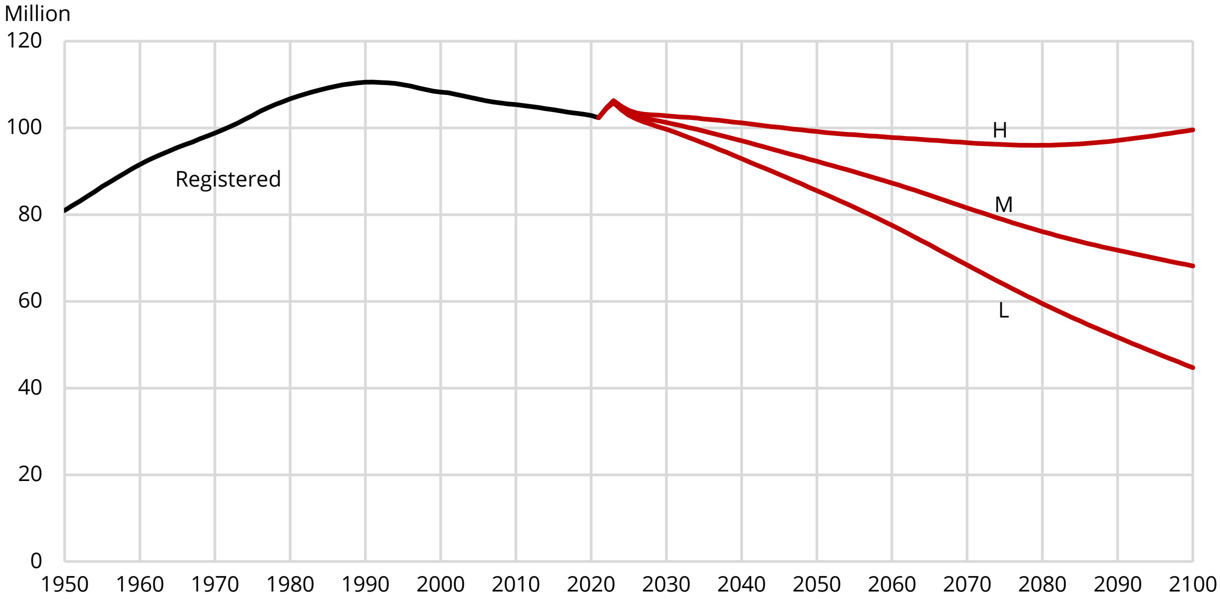
Figure 7.12 Population in Country Group 2 in three age groups, registered 1970–2021 and projected 2022-2100 by the United Nations, medium variant



Source: United Nations

The total population of CG2 is currently around 105 million. As can be seen in Figure 7.13, it is projected to fall below 70 million by 2100 according to the United Nations medium alternative. If the aggregate emigration rate to Norway from CG2 were constant, the decline in the population alone would lead to a strong reduction in annual immigration to Norway. It should also be noted that even in the United Nation's (2022) high-fertility variant, the population of CG2 does not return to its current size throughout the projection horizon.

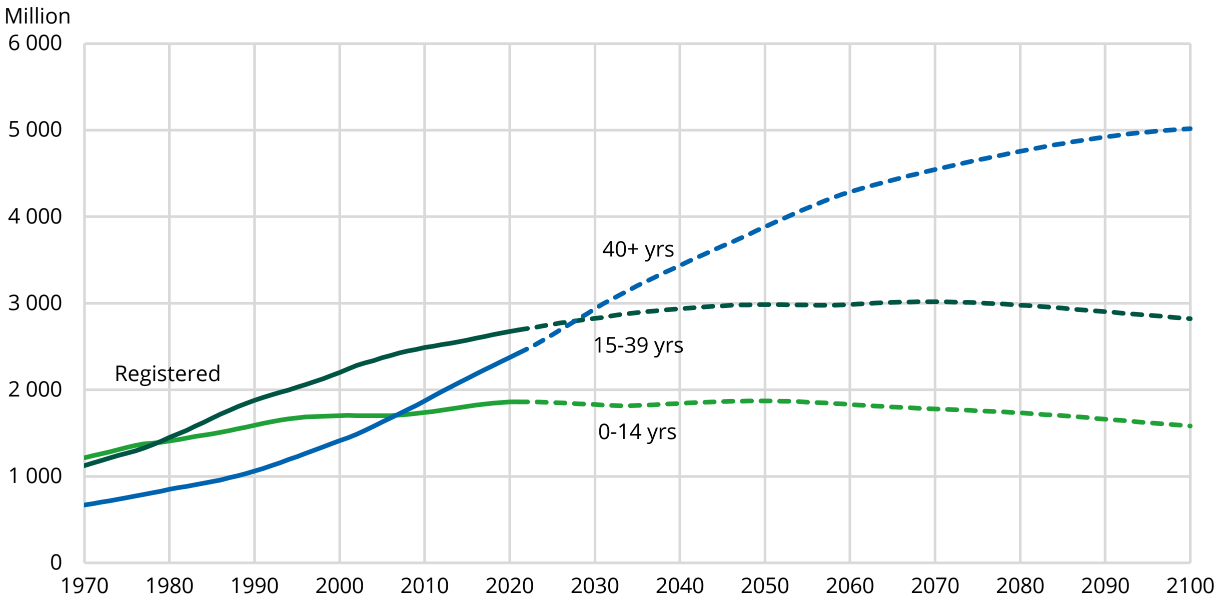
Figure 7.13 Total population in Country Group 2, registered 1950–2021 and projected 2022-2100 by the United Nations in three alternatives[1]



[1] The alternatives are medium variant (M), low-fertility variant (L), and high-fertility variant (H).
Source: United Nations

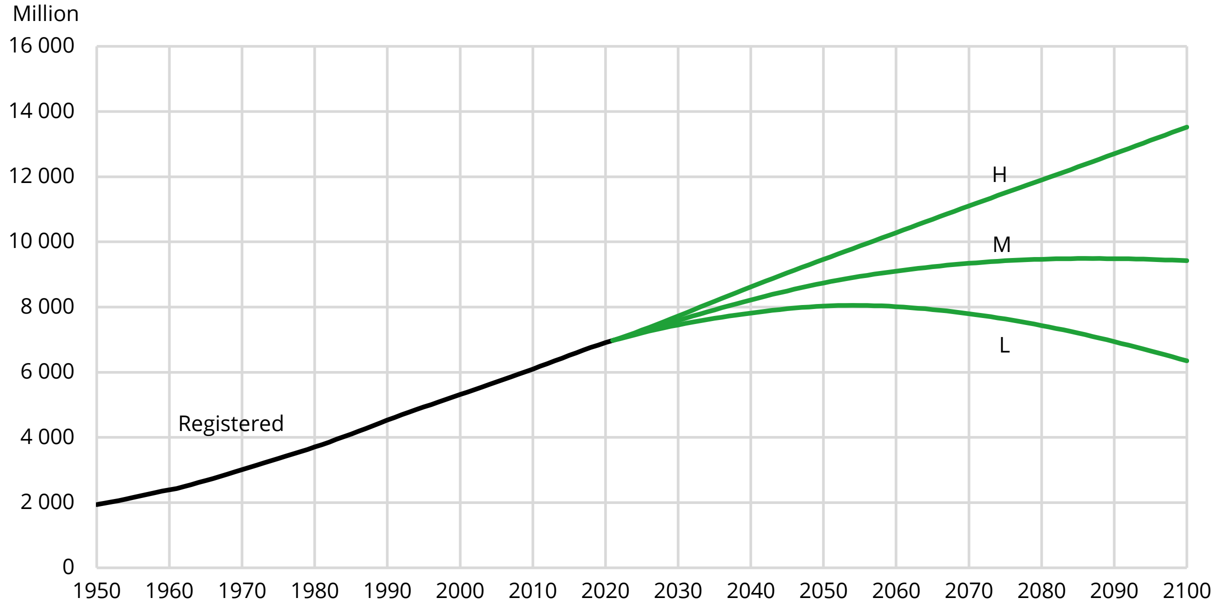
CG3 has by far the largest population of the three country groups. The figures below show the historical development as well as the projected trends in the size of the three age groups (Figure 7.14) and the total population (Figure 7.15) for CG3. According to the United Nations medium variant, the population in this country group will peak in the 2080s at around 9.5 billion. In the low-fertility variant it will reach a maximum of around 8 billion sometime during the 2050s, while in the high-fertility variant the trend in population growth over the last 30 years or so will simply continue (reaching 13.5 billion by 2100). Still, if we assume the medium variant is closer to the true future development, virtually all of population growth in CG3 is expected to take place among the oldest age groups, while the population aged 0-14 is expected to have effectively peaked already. Thus, even CG3 is expected to undergo substantial population ageing in the coming decades.

Figure 7.14 Population in Country Group 3 in three age groups, registered 1970–2021 and projected 2022-2100 by the United Nations, medium variant



Source: United Nations

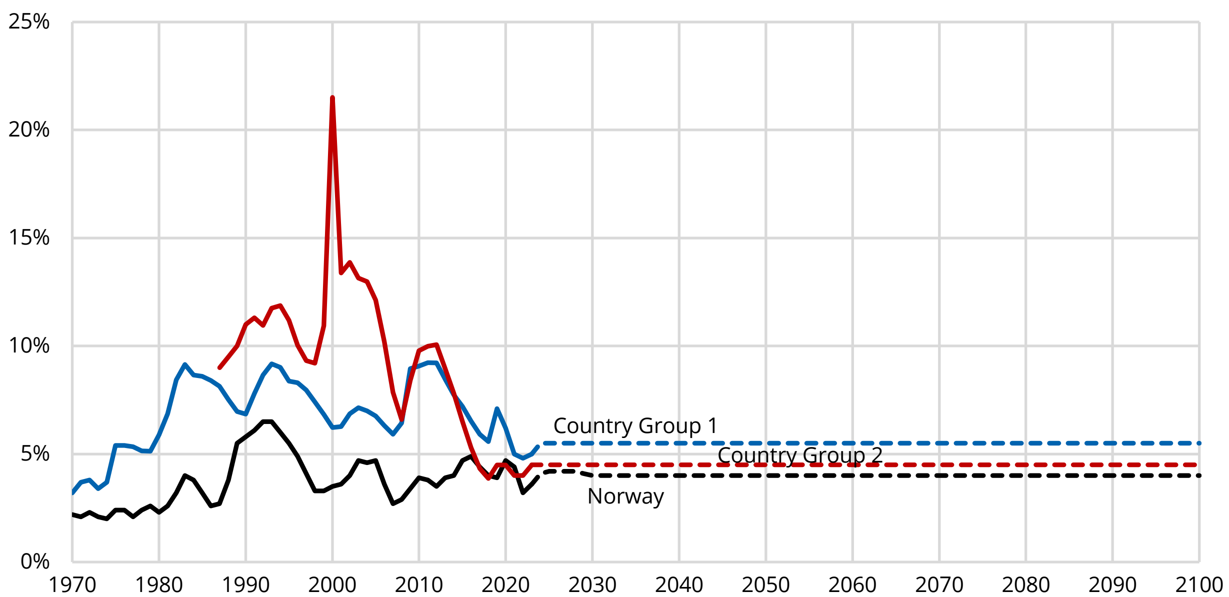
Figure 7.15 Total population in Country Group 3, registered 1950–2021 and projected 2022-2100 by the United Nations in three alternatives[1]



[1] The alternatives are medium variant (M), low-fertility variant (L), and high-fertility variant (H).
Source: United Nations

The estimation of network effects for CG3 requires a series of iterations to be run before convergence is obtained. Initial estimates of the future number of CG3 immigrants residing in Norway (which are used to identify the network effect) are based on figures from the population projections made in 2022. Once the initial number of future immigrations from CG3 has been predicted via the migration model, the updated figures on future immigrations are fed into the population projection model (BEFINN). The projection model produces new estimates for the stock of immigrants from each country group, with the figures for CG3 used to re-estimate immigration from CG3 again. Such iteration rounds are repeated several times until convergence is obtained.

Figure 7.16 Unemployment rates in Norway and Country Groups 1 and 2, registered 1970-2023 and assumed future values 2024-2100

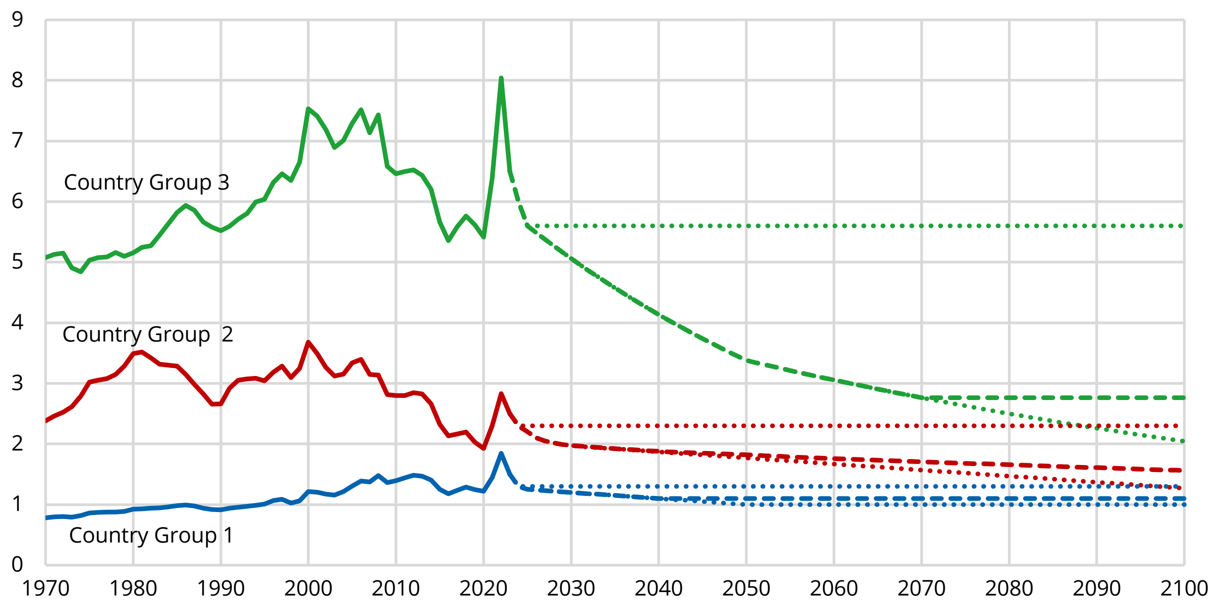


Source: Eurostat, OECD, and Statistics Norway

Figure 7.16 presents the registered and assumed future unemployment rates for Norway, CG1, and CG2. Forecasts for the unemployment rate in Norway are taken from Statistics Norway's macroeconomic projections (Statistics Norway 2024). In the long term, the unemployment rate has been levelled off to a historically 'normal' level around the average of the last three decades (4 percent). Since 2010, the unemployment rate in CG2 has significantly reduced. We assume that it will stay at a low level (4.5 percent) in the long run. For Country Group 1, the unemployment rate has also remained low over this period and again, in the long term, it is expected to stay at a relatively low level (5.5 percent). The changing demographic structure in CG1 and CG2 is one reason why we think this is a reasonable long-run assumption. The unemployment rates are assumed to be the same in all three scenarios.

Three alternative paths have been made for future income development (low, medium, and high alternatives). The high alternative assumes the greatest income differences between Norway and the rest of the world. In this case, the relative income levels are extrapolated from levels similar to recent years, albeit lower than was observed in 2022 and 2023. The Norwegian economy is highly affected by changes in the prices of crude oil and natural gas and has enjoyed dramatic terms of trade improvements, which greatly affected relative incomes in 2022 and 2023. We have assumed that oil and gas prices return to more normal levels so that the relative increase in Norwegian incomes is short lived. The medium alternative assumes that non-oil GDP per capita in Norway follows that of CG1, while the gradual phasing out of oil and natural gas exploration in Norway takes place according to the most recent figures available and thus contributes to a reduction in Norwegian GDP per capita in relative terms. In the low alternative there is absolute convergence in relative incomes between Norway and CG1 from 2050, while a trend towards convergence persists through to 2100 for CG2 and CG3, although full convergence does not occur.

Figure 7.17 Relative GDP per capita, registered 1970–2023 and assumed paths 2024-2100 in three alternatives



Source: World Bank and Statistics Norway

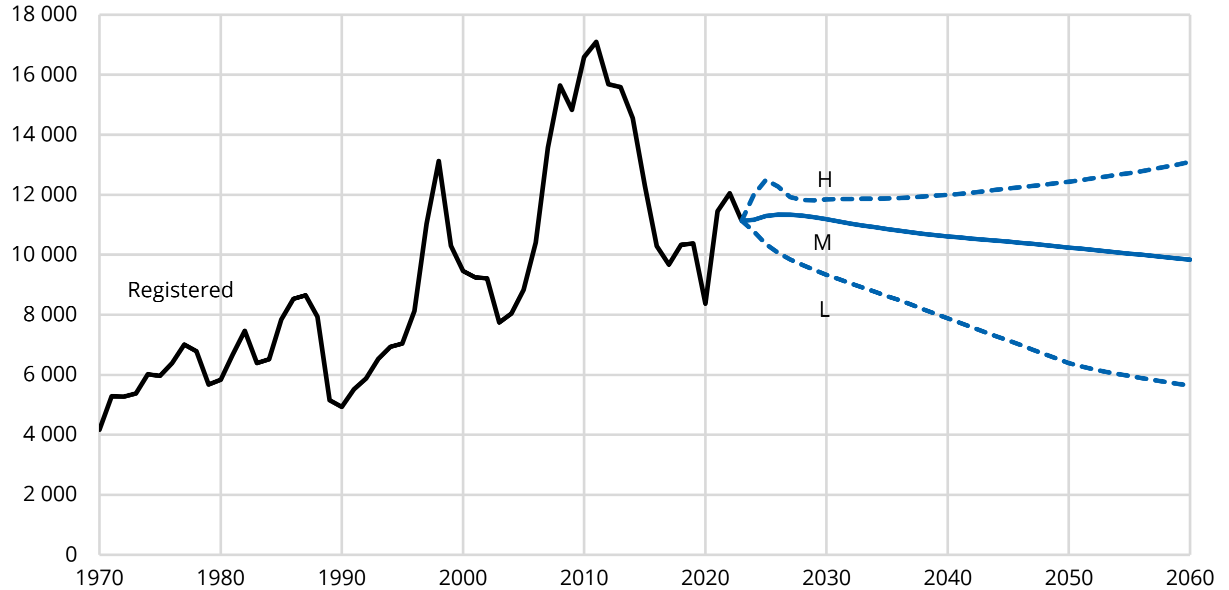
Figure 7.17 shows the historical relative income per capita ratios for each country group and for the three alternatives. For CG1 relative incomes are not expected to change much compared to the historical data in any of the three alternatives. For Country Group 2, we expect a catch up in incomes to continue in the middle and low alternatives but to different degrees. For Country Group 3, there are larger differences across the alternatives. The income ratio in the medium alternative declines from about 6.5 in 2023 to about 2.8 in 2070, thereafter it remains constant for the remainder of the projection period. This development is related to phasing-out the petroleum activity in Norway but more importantly to a continuation of economic growth in CG3. In the low scenario there is no difference to the medium alternative in the income ratio until 2070, when it is around 2.8. From this level, the income ratio in the low alternative continues to decrease, to around 2.0 in 2100. Thus, according to the low scenario, (PPP-adjusted) GDP per capita in Norway is only two times higher than the corresponding level for CG3 by 2100. In the high scenario, the income ratio is set to a constant value of 5.6 from 2025 onwards.

Projecting immigration from the three country groups

The estimated equations corresponding to (7)-(9) are utilised for dynamic projections. First, the unknown parameters are replaced by their estimates (or calibrated values) and the residuals are set to zero. Second, the log of the immigration rate of the age groups is forecasted and the rates are then multiplied with corresponding population forecasts from the United Nations. Note that we have time series for the exogenous variables on the right-hand side for the period 2024-2100. Values for the lagged right-hand side variables are obtained recursively ('dynamic forecasts').

Figure 7.18 shows the projected gross immigration to Norway from CG1 in three alternatives. In 2023, immigration from CG1 was around 11 000 and our medium alternative assumes a similar level of annual immigration up to 2040, before a modest decline starts to take hold. By 2050 the medium alternative for CG1 is around 10 000 gross immigrations. This decline is mainly due to lower relative incomes for Norway, making Norway a less attractive country to live and work in compared to what has been the case in previous years, as well as the population ageing that continues to take hold in CG1. In the high alternative, relative incomes are held constant and the small increase in immigrations over time is primarily driven by the population growth of CG1 associated with the United Nations (2022) high-fertility variant. The low alternative differs only marginally from the medium alternative when it comes to relative incomes, so it is the population decline associated with the United Nations (2022) low-fertility variant that drives the strong reduction in annual immigration to Norway.

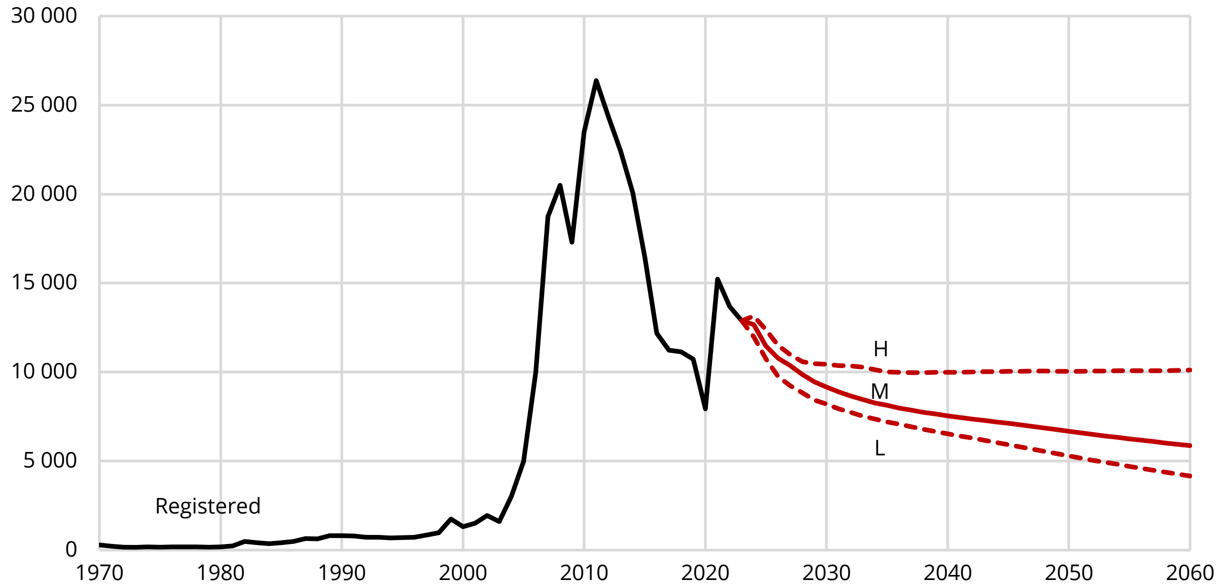
Figure 7.18 Gross immigration to Norway from Country Group 1, registered 1970-2023 and projected 2024-2060 in three alternatives[1]



[1] The alternatives correspond to the medium (M), low (L), and high (H) immigration assumptions.
Source: Statistics Norway

Projected immigration from CG2 is shown in Figure 7.19. Our medium alternative assumption regarding relative incomes between Norway and CG2 (Figure 7.17), is that trends towards convergence will continue. When combined with strong population ageing and population decline in CG2, we expect gross immigration from CG2 to fall in all three alternatives. In the medium alternative, annual immigration from CG2 is projected to fall from its current level, at 12 900, to below 7 000 by 2050 and below 6 000 by 2060. The low alternative projects gross immigration from CG2 in 2050 and 2060 to be around 5 000 and 4 000, respectively, while for the high alternative immigration remains around 10 000.

Figure 7.19 Gross immigration to Norway from Country Group 2, registered 1970-2023 and projected 2024-2060 in three alternatives[1]

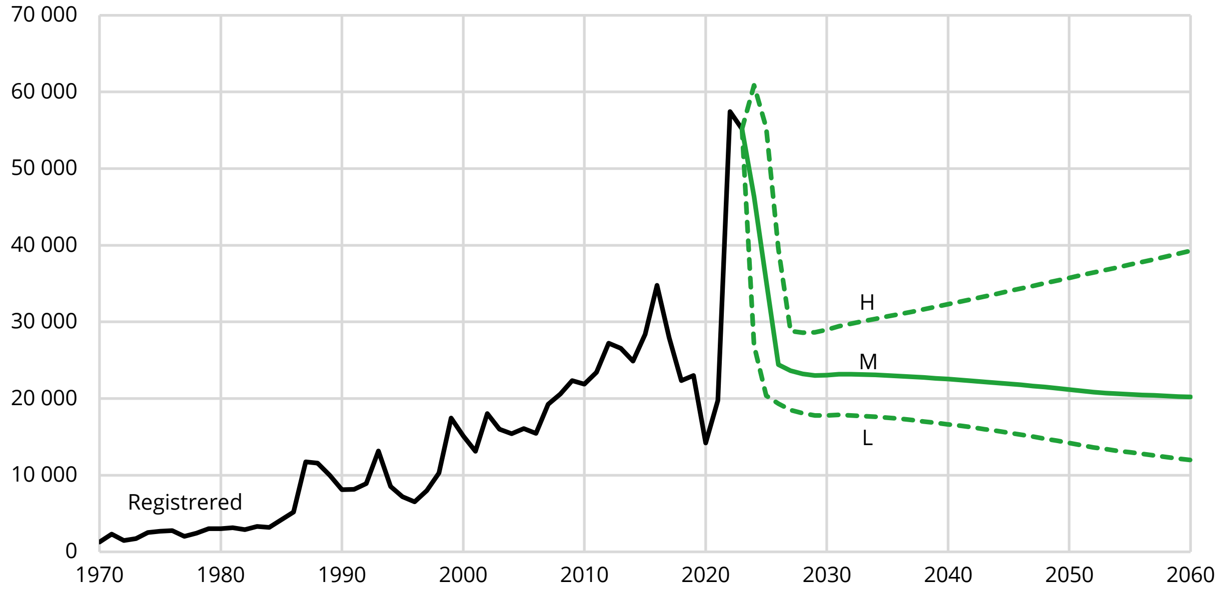


[1] The alternatives correspond to the medium (M), low (L), and high (H) immigration assumptions.
Source: Statistics Norway

Figure 7.20 shows the projected gross immigration of persons from CG3 according to the three immigration alternatives. The war in Ukraine is assumed to have a strong influence on immigration from this group in the short term (see Section 7.1). In the medium alternative, gross immigration from CG3 is projected to be around 46 000 persons in 2024 and around 35 000 in 2025.[17] Thereafter we project a gradual decline, with gross immigration projected to be about 24 000 in 2026, 21 000 in 2050, and 20 000 in 2060. This gradual decline in the medium alternative is again driven by the relative decline in incomes in Norway as well as a limited growth, and eventual decline, in the younger age groups in CG3. In the low alternative, gross immigration from CG3 is assumed to drop sharply to 27 000 in 2024 and decline further to 14 000 by 2050 and 12 000 by 2060.[18] In the high alternative, CG3 gross immigration is projected to be 61 000 in 2024, 55 000 in 2025, and 40 000 in 2026.[19] Thereafter, gross immigration from CG3 declines to 29 000 in 2027, before gradually increasing to 36 000 in 2050 and 39 000 in 2060 as high alternative assumptions for population growth and limited economic catch up for CG3 take hold.

[17] The *ad hoc* adjustment to the medium alternative represents an additional 20 000 gross immigrations in 2024, followed by an additional 10 000 in 2025 (30 000 in total).
[18] The *ad hoc* adjustment to the low alternative represents an additional 5 000 gross immigrations in 2024.
[19] The *ad hoc* adjustment to the high alternative represents an additional 30 000 gross immigrations in 2024, 25 000 in 2025 and 10 000 in 2026 (65 000 in total).

Figure 7.20 Gross immigration to Norway from Country Group 3, registered 1970-2023 and projected 2024-2060 in three alternatives[1]

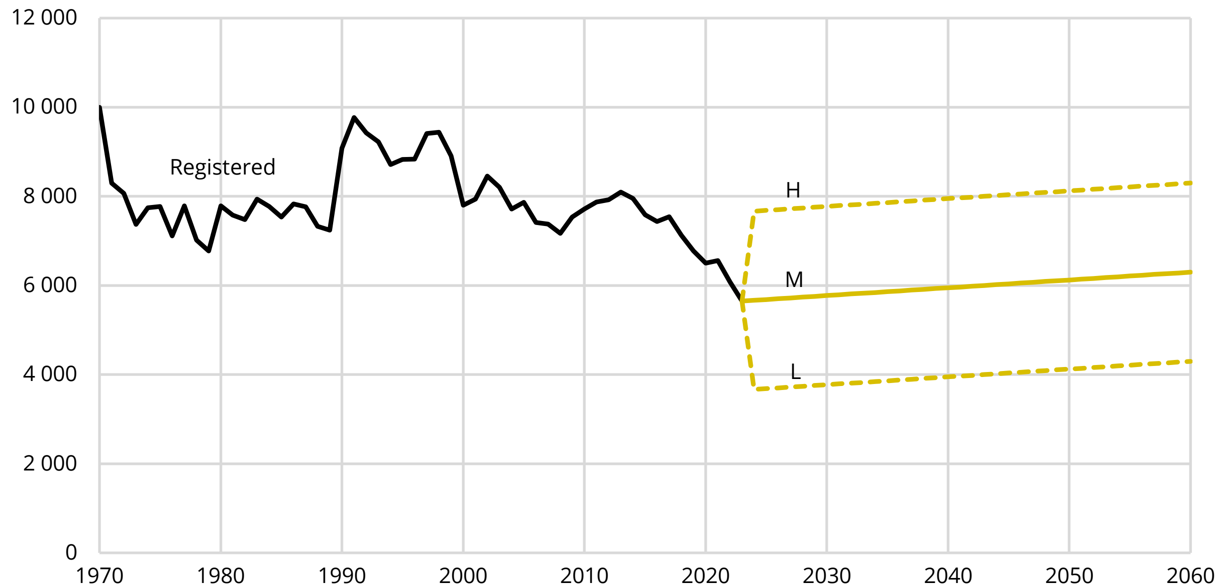


[1] The alternatives correspond to the medium (M), low (L), and high (H) immigration assumptions.
Source: Statistics Norway

7.4. Immigration of non-immigrants

Every year, a number of people with a Norwegian background return to live in Norway. This group also includes persons born in Norway to two foreign-born parents. Assumptions about the future immigration of this group are based on registered immigration patterns over the past decade, but also account for an assumed marginal increase in the trend towards 2100 (see Section 4.3 for details). The medium alternative projects the immigration of 'non-immigrants' to increase from around 5 700 today, to 6 100 in 2050 and 7 000 in 2100. The high and low alternatives are 2 000 higher/lower than the medium alternative throughout the projection period (Figure 7.21).

Figure 7.21 Gross immigration to Norway among non-immigrants, registered 1970-2023 and projected 2024-2060 in three alternatives[1]

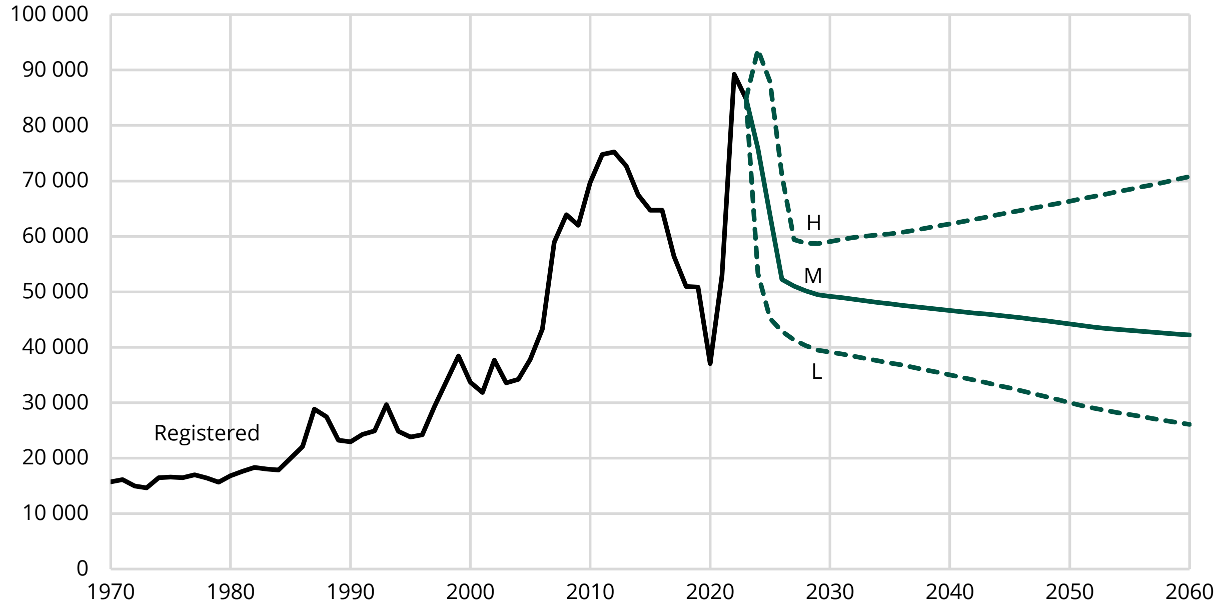


[1] The alternatives correspond to the medium (M), low (L), and high (H) immigration assumptions.
Source: Statistics Norway

7.5. Uncertainty associated with future immigration

The total future immigration to Norway is comprised of immigrations from the three country groups, as well as of the non-immigrants. As can be seen in Figure 7.22, the *ad hoc* adjustments made to CG3 have quite substantial short-term effects on gross immigration to Norway. Thereafter, the yearly immigration to Norway in the medium alternative is assumed to decline gradually to around 50 000 in 2030, 45 000 in 2050, and 40 000 in 2100. With that said, the uncertainty in these figures should not be overlooked. For the low immigration alternative, all groups experience reduced immigration over time, with total gross immigrations declining to around 40 000 in 2030, 30 000 in 2050, and 15 000 in 2100. Meanwhile, the high immigration alternative projects a record gross immigration in 2024, at almost 95 000, before it declines sharply in line with the *ad hoc* adjustments for Ukraine in 2025 and 2026. From 2027, high alternative gross immigration increases over time to reach more than 65 000 in 2050 and almost 90 000 by 2100.

Figure 7.22 Total gross immigration to Norway, registered 1970-2023 and projected 2024-2060 in three alternatives[1]



[1] The alternatives correspond to the medium (M), low (L) and high (H) immigration assumptions.
Source: Statistics Norway

Projections for immigration are typically far more uncertain than those for the other two demographic components (Thomas et al. 2022). In the long term, there are substantial uncertainties associated with the assumed paths for the explanatory variables in the model, i.e., income disparities, network effects, and unemployment rates. It is also possible that the influence of such variables on immigration patterns changes over time. In our model, the network effect is captured by the number of immigrants from CG3 already living in Norway. As we will show in Figure 7.34, a growing share of CG3 immigrants will have long durations of residence, due to their relatively low emigration propensities. There is limited knowledge on whether the network effect remains strong after immigrants have lived in the destination country for many years. Indeed, some have arrived as children. If the network effect diminishes with duration of stay, our estimates for the future effect may be too high.

Furthermore, there are many other factors that can have a large bearing on immigration but that are challenging, if not impossible, to predict. This applies not least to future political changes, such as potential EU expansion as well as broader changes to European and Norwegian asylum and immigration policies. History has shown us that after large influxes, policies are often put in place to reduce future entries, such as was the case in the aftermath of the so-called Syrian refugee crisis in 2015-2016. The travel restrictions associated with the COVID-19 pandemic also highlight the ways in which international migration can be dramatically affected by unforeseen events. While these factors primarily affect the demand side, acts of war, conflicts, and natural disasters are examples of supply side factors that can have marked impacts on immigration levels. In addition to the difficulties in predicting when and where wars or pandemics will break out or end, attempts to reasonably quantify the political response to such events would likely prove fruitless.

Prior to 2020, our projections did not account for the expected age development in the three country groups, which was itself an additional source of uncertainty. Given that migration propensities are closely tied to age schedules, the expected ageing of populations across all regions of the world should result in generally lower rates of international migration in the future. With that said, it may also lead to increased competition between nations to attract migrants, as the share of working age populations declines and domestic demand for labour increases. This process is already evident in, for instance, the health and care sector in many Western contexts.

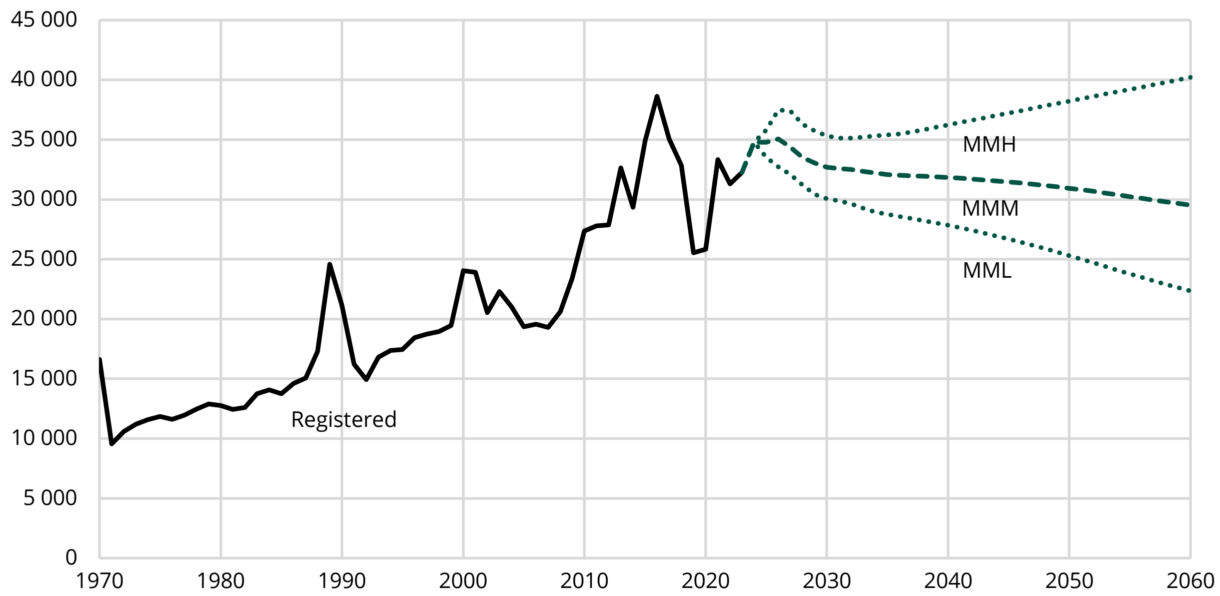
While uncertainty usually increases as we move further from the projection baseline, the ongoing war in Ukraine makes it challenging to formulate even short-term immigration assumptions in this year's projections. How long the war will last, how severe the refugee crisis and related economic impacts will be, is unclear. In our projections, we have assumed a return to relative normality in 2025 in the low alternative, 2026 in the medium alternative, and 2027 in the high alternative. Clearly, these assumptions are very uncertain.

7.6. Emigration from Norway

Emigration in the population projections is calculated using emigration probabilities derived from recent trends in the registered data (see Section 4.3 for details). As shown in Figure 7.9, non-immigrants have the lowest propensity to emigrate. Among the immigrant populations, those from CG3 have the lowest emigration propensities, typically followed by CG2. While immigrants from CG1 have traditionally had the highest emigration rates, there has been a clear reduction in the share of CG1 immigrants emigrating over recent decades (from almost 10 percent in 2000 to under 4 percent in 2023). Emigration propensities are highest in the first few years following immigration to Norway and decrease with duration of stay (Pettersen 2013, Skjerpen et al. 2015). Consequently, high immigration one year will lead to higher emigration in the years that follow. We typically only define a medium emigration assumption. The variations in the emigration figures in the different immigration alternatives, as well as the other commonly used alternatives, result purely from differences in the underlying population's size and composition. As noted in Section 7.1, we have not included any *ad hoc* adjustments to the data-driven emigration probabilities in response to the Ukraine situation.

Figure 7.23 shows projected emigration from Norway in three alternatives. The high and the low alternatives refer to the high (MMH) and low (MML) immigration alternatives, respectively. As is evident from Figure 7.23, the main alternative projects emigration to slightly increase in the short term, from 32 000 today to around 35 000 in 2026. This short-term increase is driven by the high numbers of recent immigrant arrivals. Following this, we assume emigration to decline year-on-year. The main alternative projects approximately 30 000 emigrations to occur in 2050. We assume a more pronounced decline in emigration in the low immigration alternative, at around 25 000 in 2050, and an increase in emigrations in the high immigration alternative, at almost 40 000 in 2050.

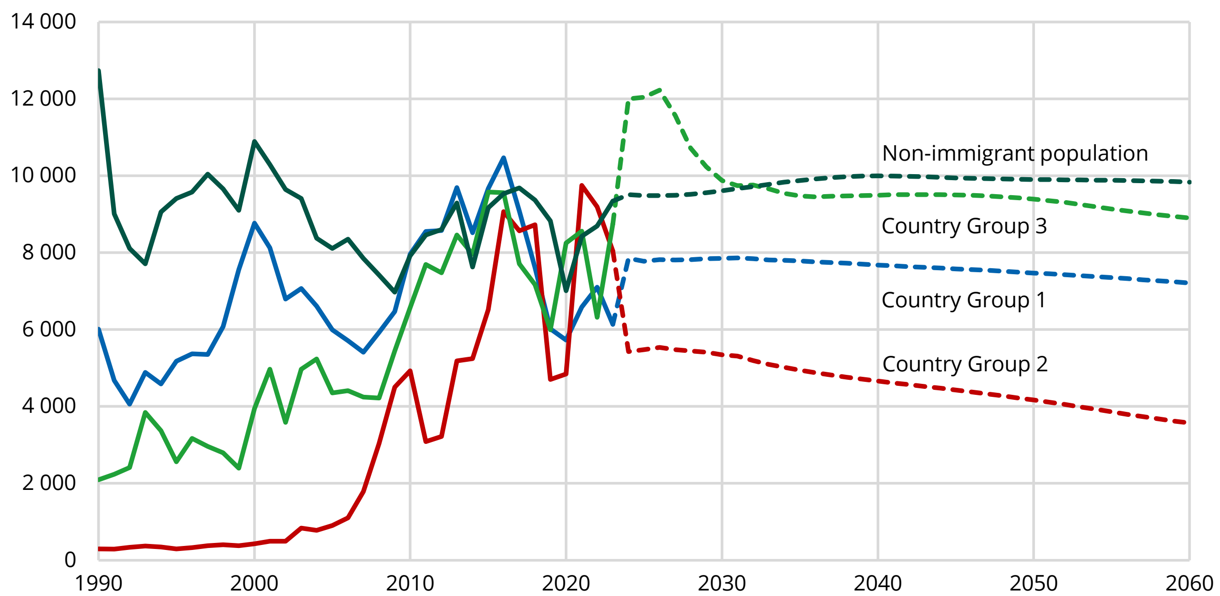
Figure 7.23 Emigration from Norway, registered 1970-2023 and projected 2024-2060 in three alternatives[1]



[1] The high and the low alternatives refer to the high (MMH) and low (MML) immigration alternatives, respectively.
Source: Statistics Norway

Figure 7.24 shows the main alternative projected annual emigrations disaggregated by the three country groups as well as the rest of the population (non-immigrants). The main alternative projects a decline in the emigration of immigrants from CG2, which corresponds with the expected reduction in immigration from this group. We expect a relatively high number of emigrations from CG3 immigrants in the short term, which is linked to the recent increase in immigration associated with the arrival of Ukrainian refugees. Thereafter, emigrations among CG3 immigrants start to decline. Future emigration numbers for CG1 immigrants, as well as non-immigrants, are expected to remain broadly similar those observed in recent years, albeit with a downward trend over time.

Figure 7.24 Emigration from Norway for immigrants from three country groups and the rest of the population, registered 1990-2023 and projected 2024-2060, main alternative



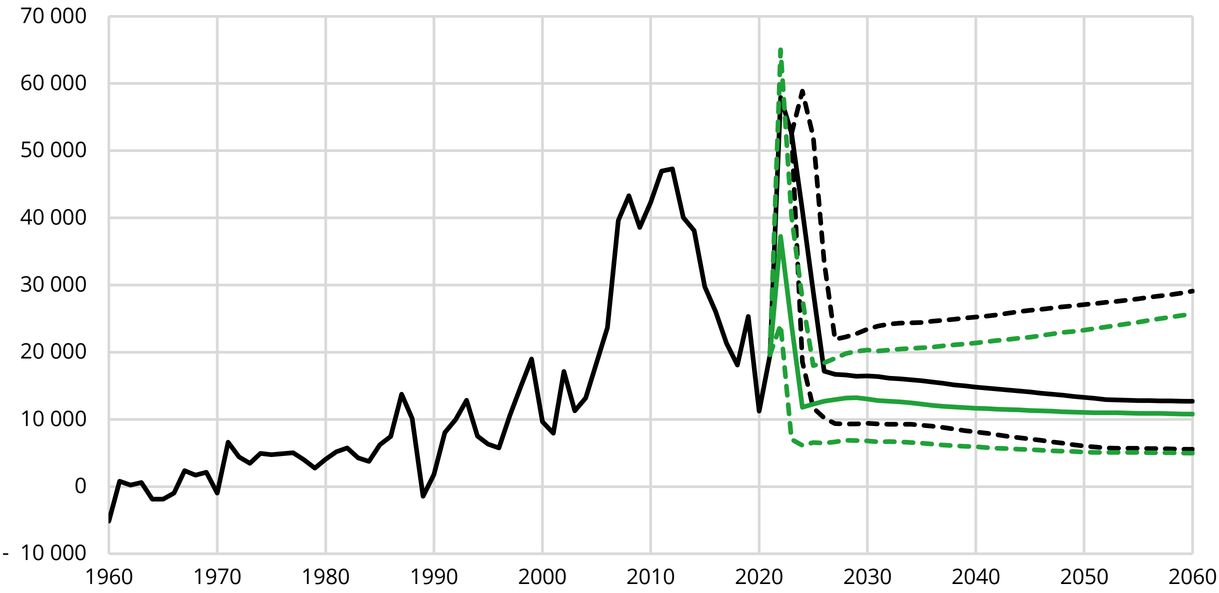
Source: Statistics Norway

The projected number of emigrations is also particularly uncertain. Changes in Norwegian immigration regulations, with more temporary residence permits and more withdrawals of permits, may contribute to an increase in emigration. The recent implementation of dual citizenship, which took effect 1 January 2020 (www.udi.no/en/word-definitions/dual-citizenship/), may also affect future emigration propensities. It is, however, difficult to know whether the effects will be sizeable. As noted in Section 7.1, the duration and cessation of ongoing wars may also influence emigration propensities in the short term. More broadly, economic convergence and strong population ageing elsewhere might encourage a gradual increase in emigration among migrant workers in Norway – e.g., via increased demand for labour, higher wages, or a need to assist older family members in the country of origin.

7.7. Net migration

Net migration is calculated by deducting emigrations from immigrations for a given year.[20] Projected net migration for this year's main alternative (MMM), low national growth alternative (LLL), and high national growth alternative (HHH) is shown in Figure 7.25, together with the equivalents produced in the 2022 projection round. This year's projections assume higher net migration than the previous projections for all alternatives except for the low national growth alternative, and only in the longer term. Both models employed the same forecasting methodologies, which forecast immigration for three age groups from each of the three country groups. In the short term, net migration is clearly higher due to the new *ad hoc* adjustments for Ukraine. In the medium to long run, the higher net migration in the 2024 projections reflects differences in the assumptions, namely where we now assume a slower convergence towards Norway's income level for the other country groups. Operating in the opposite direction are updated assumptions from the United Nations (2022) projections, which assume weaker population growth globally than was the case in the previous projection round. Net migration in the 2024 main alternative is 41 000 in 2024 and 29 000 in 2026, after which it broadly stabilises at around 13 000 per year from 2050 onwards.

Figure 7.25 Net migration, registered and projected in the 2022 (green) and 2024 (black) projections in three alternatives[1]



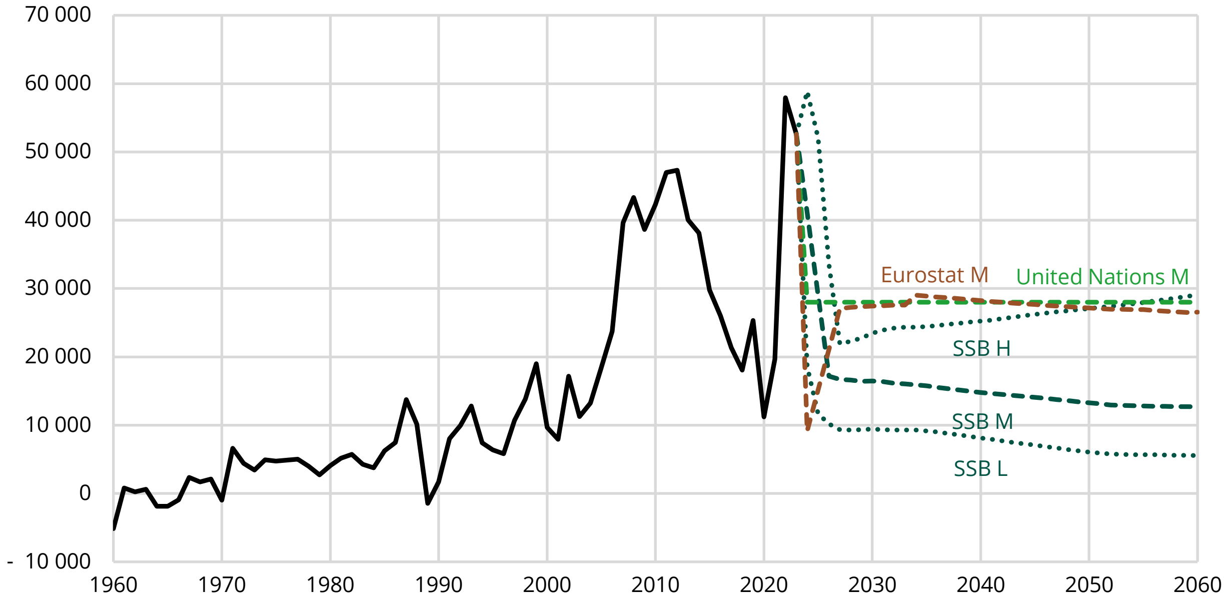
[1] The solid lines represent the main alternatives (MMM), the upper dashed lines show the high national growth alternatives (HHH)), while the lower dashed lines show the low national growth alternatives (LLL).
Source: Statistics Norway

[20] Prior to 2011, specific assumptions about future net migration were made. Since then, net migration is simply a calculation based on the assumed gross immigrations and emigrations.

7.8. Projected net migration from alternative producers

Both Eurostat (2023) and the United Nations (2022) have published their own net migration projections for Norway. The United Nations (2022) projections assume a constant net migration of 28 000 per year up to 2100 in Norway. The Eurostat (2023) projections assume low net migration in the short term in Norway, before it gradually increases to around 29 000 per year in the 2030s. By 2050, the Eurostat net migration assumption is 27 000, and by 2100 net migration is assumed to be 25 000. Thus, in the long run, Eurostat is also assuming a declining net migration for Norway. As can be seen from Figure 7.26, the projections from both the United Nations and Eurostat are closer to Statistics Norway's high national growth alternative (HHH). Statistic Norway's main alternative (MMM) is markedly lower.

Figure 7.26 Comparing net migration projections from Eurostat, United Nations and Statistics Norway, registered 1960-2023 and projected 2024-2060[1]



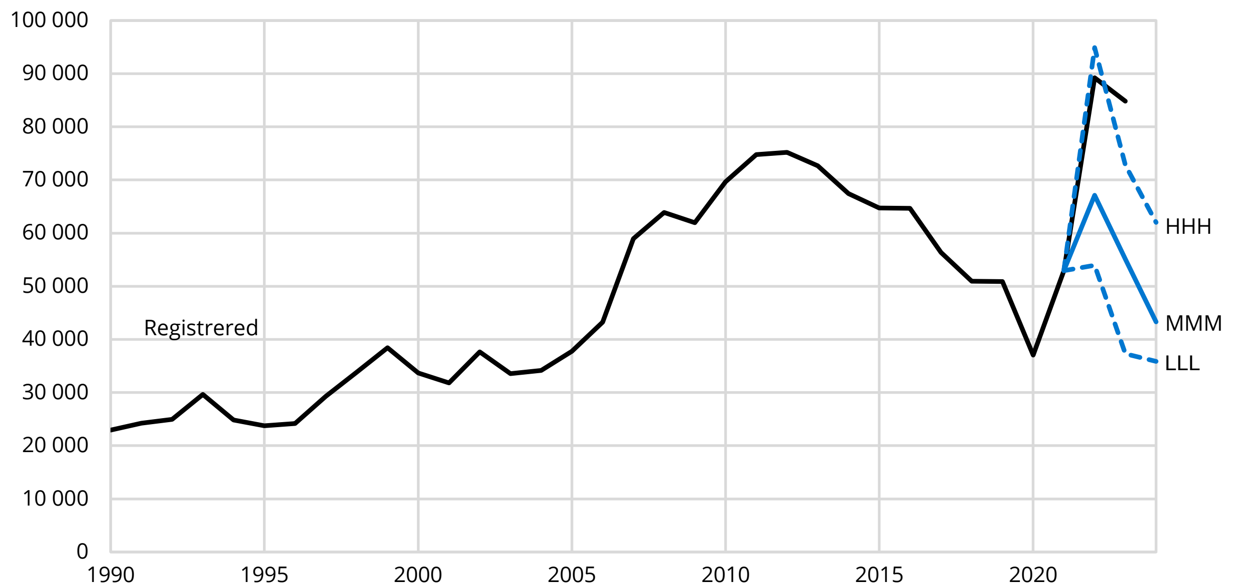
[1] The medium variant (M) is shown for United Nations, whereas the baseline scenario (M) is shown for Eurostat. Statistics Norway's (SSB) net migration figures are shown in the main (MMM), low national growth (LLL), and high national growth (HHH) alternatives.
Source: Eurostat (2023), Statistics Norway, United Nations (2022)

7.9. Accuracy of the last projection

The last round of population projections was published in July 2022. It assumed a similar population growth to that projected in the 2020 projections but considerably lower than that produced in 2018 (see Chapter 1, Figure 1.20). The differences in population growth between the previous projection rounds were in part the result of the different immigration assumptions. As with this year's projections, the 2022 projections had to contend with the short-term uncertainty associated the war in Ukraine. In this section, we assess the short-term accuracy of the 2022 immigration assumptions. A thorough review of the accuracy of previous population projections is given in Thomas et al. (2022).

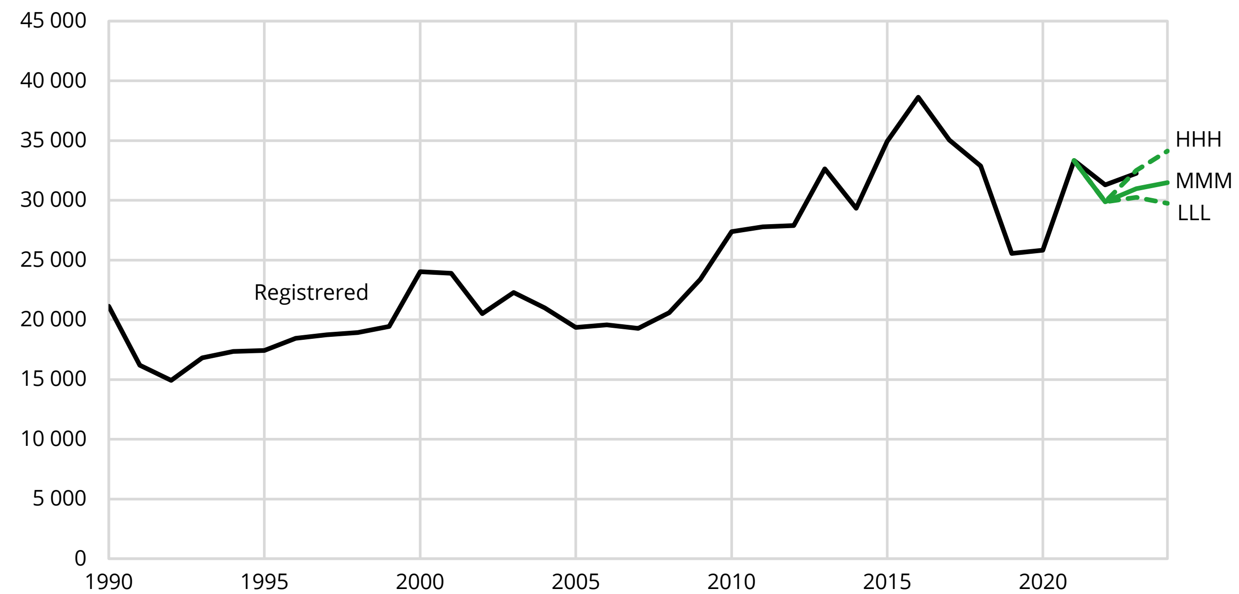
Figures 7.27-7.29 compare registered gross immigration, gross emigration, and net migration in 2022 and 2023 with the comparable measures from the main (MMM), low (LLL) and high (HHH) national growth alternatives produced in 2022. The registered figures show that gross immigration to Norway in 2022 was a record 89 200. This was 22 100 higher than in the main alternative but within the high alternative by approximately 6 000 immigrations. For 2023, the registered figure was 84 800, which was almost 30 000 higher than the main alternative and 12 000 higher than even the high alternative. As with this year's projection, the 2022 projection made *ad hoc* adjustments for the Ukraine war. In the medium alternative, we assumed 20 000 additional CG3 immigrations in 2022 and an extra 10 000 in 2023. We observed a gross immigration of 30 400 Ukrainians in 2022 and 30 800 in 2023. Thus, on top of an underestimation of the true number of Ukrainian arrivals in these years, the underlying model-based immigration numbers for the medium alternative, excluding Ukrainians, were approximately 10 000 lower than the equivalent observed values in both years. In fact, if we remove Ukrainians from the registered gross immigration numbers for 2022 and 2023, the levels of immigration in those years were still higher than in any year since 2017. In the 2016 projections, which were produced during the Syrian refugee crisis, we observed a short-term overestimation in the main alternative, of around 10 000 immigrations from CG3 in 2017.

Figure 7.27 Immigration to Norway, registered 1990-2023 and projected in the 2022 projections



Source: Statistics Norway

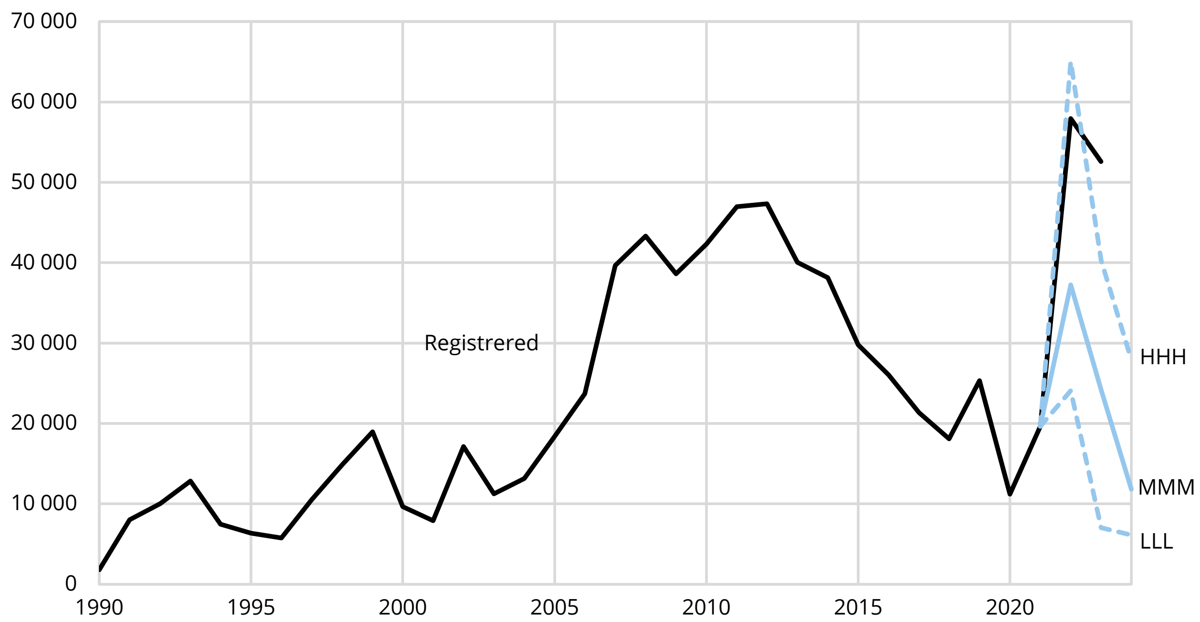
Figure 7.28 Emigration from Norway, registered 1990–2023 and projected in the 2022 projections



Source: Statistics Norway

While emigration was also underestimated in the short term, the scale of the underestimation was relatively small, at just over 1 400 emigrations in 2022 and 1 300 emigrations in 2023. As such, the discrepancy between registered and projected net migration is almost entirely driven by the underestimation in gross immigration. The short-term discrepancy between actual and projected net migration is shown in Figure 7.29.

Figure 7.29 Net migration, registered 1990–2023 and projected in the 2022 projections

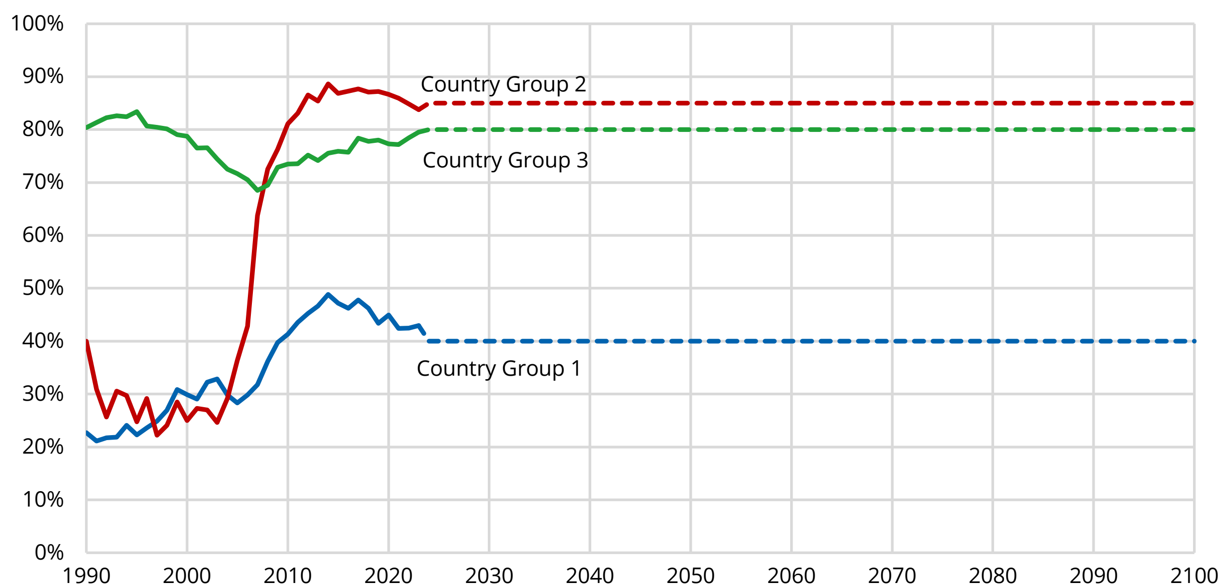


Source: Statistics Norway

7.10. Norwegian-born children with two immigrant parents

Through the projections of immigration and emigration (together with assumptions for future fertility and mortality), one can derive estimates of the future number of immigrants as well as Norwegian-born children with two immigrant parents. To calculate the number of Norwegian-born children with two immigrant parents, we also need to make assumptions about the proportion of immigrant women who will have children with immigrant men. These latter assumptions are based on assessments of observed trends for each of the country groups, as shown in Figure 7.30.

Figure 7.30 Share of immigrant women who have children with immigrant men, by country group, registered 1990-2023 and projected 2024-2060



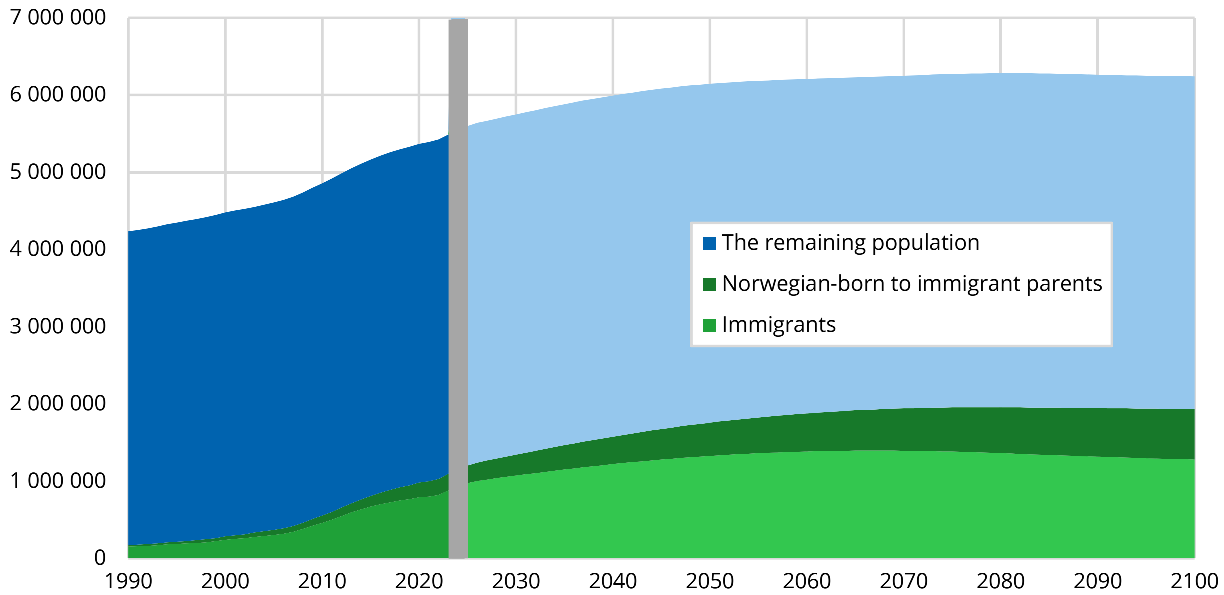
Source: Statistics Norway

In recent years, the shares have been highest for women from CG2, with almost 90 percent of the children born to CG2 immigrant women having an immigrant father. This share increased considerably following the eastward expansion of the EU, although in more recent years we have observed a slight decline. In the coming years, we have chosen to keep the share at a similar level to that observed today, i.e., at 85 percent. For CG3, the share has remained relatively stable, and here again we expect the proportion to remain at current levels, approximately 80 percent. The relative share for immigrant women in CG1 is low, at least when compared to the other groups. The proportion peaked in 2014, at 49 percent, before steadily declining to just over 40 percent today. For the coming years, we assume this share will be 40 percent.

7.11. Immigrants and their descendants in the years ahead

Figure 7.31 shows the development in absolute numbers for immigrants, Norwegian-born to two immigrant parents, and the rest of the population in the main alternative. According to the main alternative, the number of immigrants is expected to increase from 931 100 today, to around 1.3 million in 2050 and around 1.4 million in 2070, after which it begins to slowly decline. In the low immigration alternative, the total immigrant population peaks at just over 1.1 million in the early 2050s, before falling to just over 700 000 by 2100. In the high immigration alternative, the total immigrant population continues to grow, reaching almost 1.6 million by 2050 and just under 2.5 million by 2100.

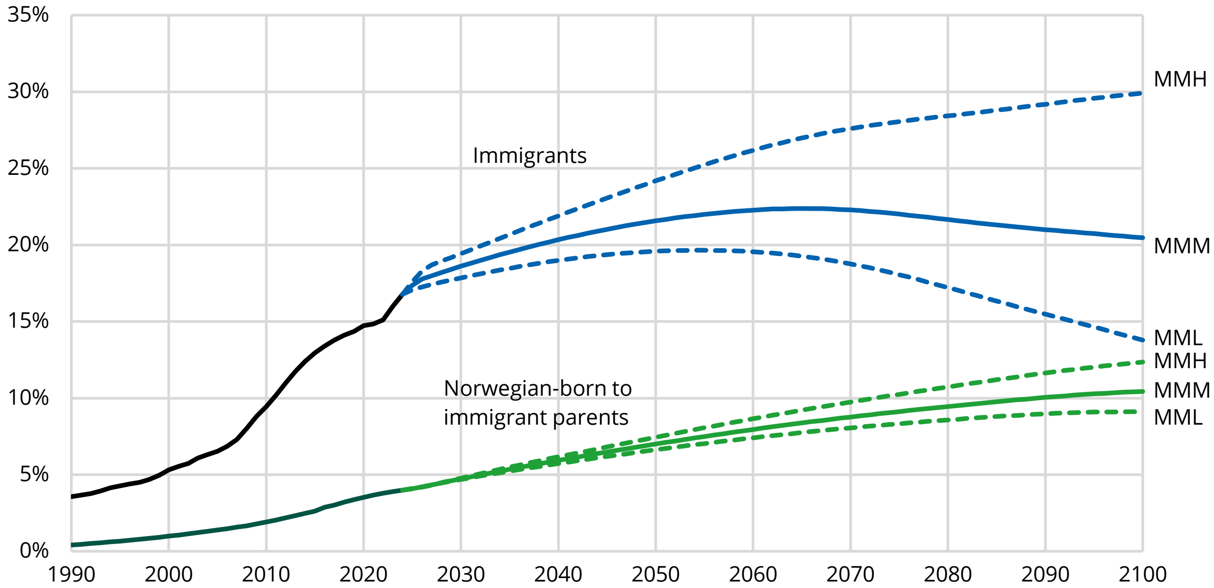
Figure 7.31 Immigrants, persons born in Norway to two immigrant parents, and the rest of the population, registered 1990–2024 and projected 2025-2100, main alternative (MMM)[1]



[1] The population estimates refer to the population on 1 January.
Source: Statistics Norway

Immigrants accounted for 16.8 percent of the population in Norway at the start of 2024, while Norwegian-born to two immigrant parents constituted 4.0 percent of the total population. How high these proportions will be in the future largely depends on future trends in immigration and emigration. Figure 7.32 shows the development according to the main alternative, as well as the alternatives for high and low immigration. In the main alternative, the proportion of immigrants increases to 22 percent by 2050 (24 percent high, 20 percent low). As we move further forward in time, the differences between the alternatives clearly increase. With regards to the development in the share of Norwegian-born to two immigrant parents, increases are assumed in all three alternatives and the relative differences between them are small. By 2050, the share of Norwegian-born to two immigrant parents is approximately seven percent in the main, low, and high alternatives. By 2100, this share is expected to increase to over 10 percent of the total population in the main alternative (9 percent low, 12 percent high).

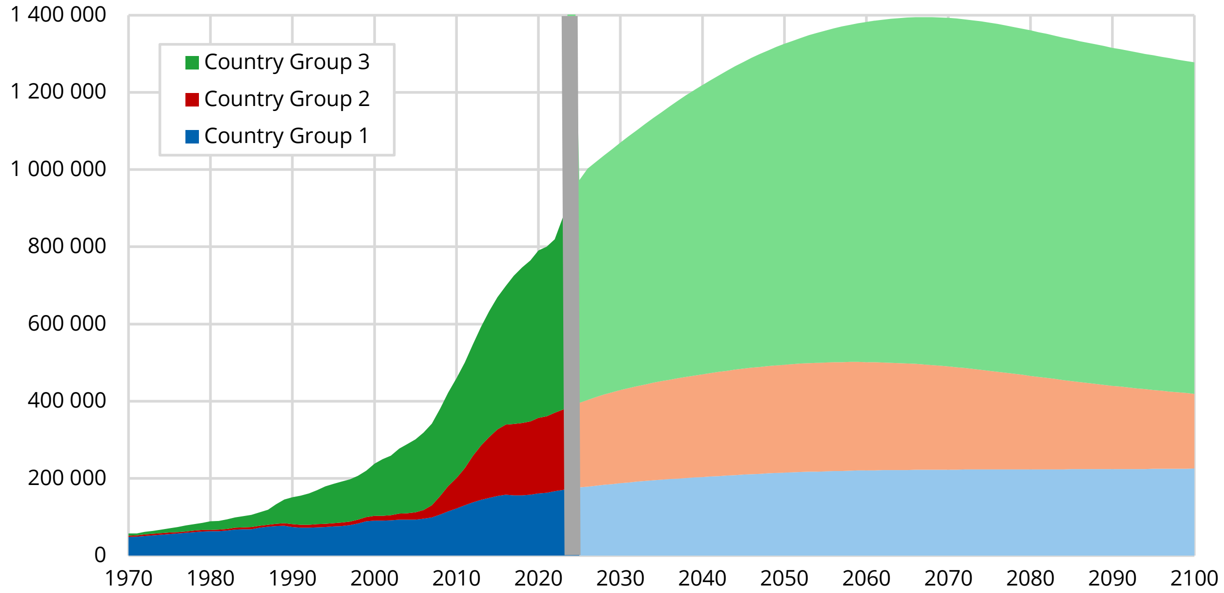
Figure 7.32 Immigrants and Norwegian-born to two immigrant parents as a share of the total population, registered 1990–2024 and projected 2025–2100 in three alternatives[1]



[1] The population estimates refer to the population on 1 January.
Source: Statistics Norway

As was shown in Figures 7.18-7.20, we project a long run decline in immigration from all three immigrant country groups in our medium alternative. In Figure 7.33, we show the development in the number of immigrants from the three country groups projected to be living in Norway in the main alternative. At the start of 2024, the number of resident immigrants from CG1, CG2, and CG3 comprised 174 000, 212 000, and 545 000 persons, respectively. By 2050, the corresponding figures for the main alternative are 215 000, 280 000, and 831 000. For CG1, the number of resident immigrants continues to increase to 2100, where it is expected to total 225 000. For CG2 and CG3 on the other hand, the main alternative projects a decline in total numbers after a certain period. For CG2 this decline begins in the 2060s, with the number of resident immigrants falling to 194 000 by 2100. For CG3 the decline starts in the 2070s and ends with a total CG3 immigrant population of 858 000 in 2100.

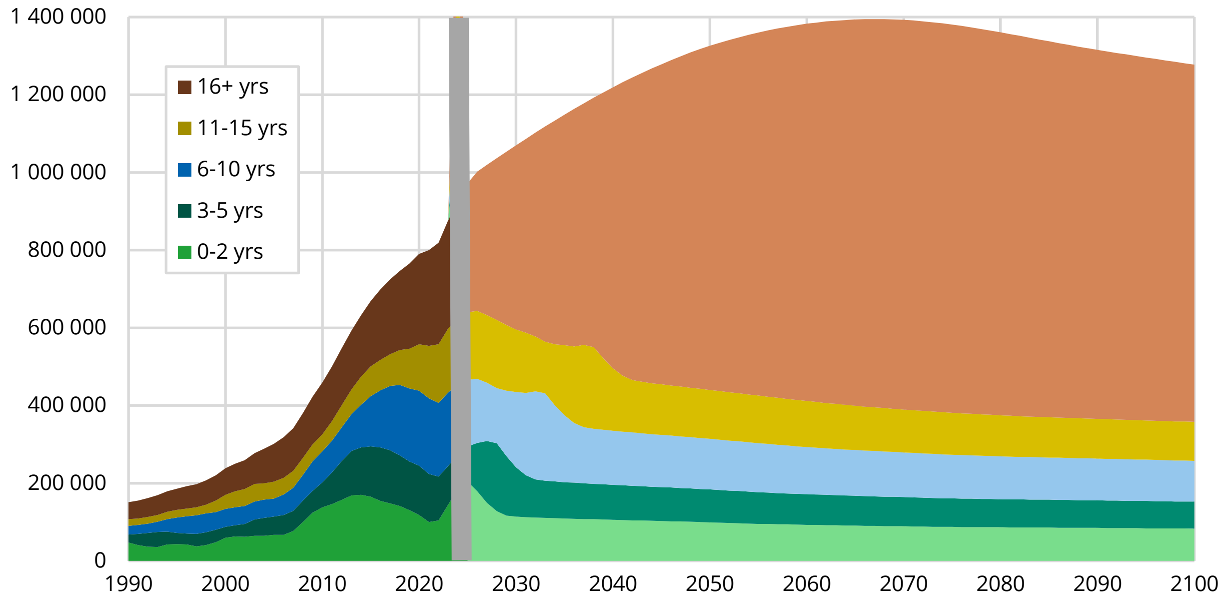
Figure 7.33 Immigrants in Norway by country group, registered 1970–2024 and projected 2025–2100, main alternative (MMM)[1]



[1] The population estimates refer to the population on 1 January.
Source: Statistics Norway

The longer a person has been living in Norway, the less likely he or she is to emigrate. As a consequence, we project a gradual increase in the number of immigrants with long durations of stay (Figure 7.34). Today, 33 percent of immigrants have lived in Norway for more than 15 years. By 2050, the main alternative expects this share to have approximately doubled, to 67 percent. From 2070 onwards, the share of immigrants with more than 15 years of residence is projected to stabilise at around 72 percent.

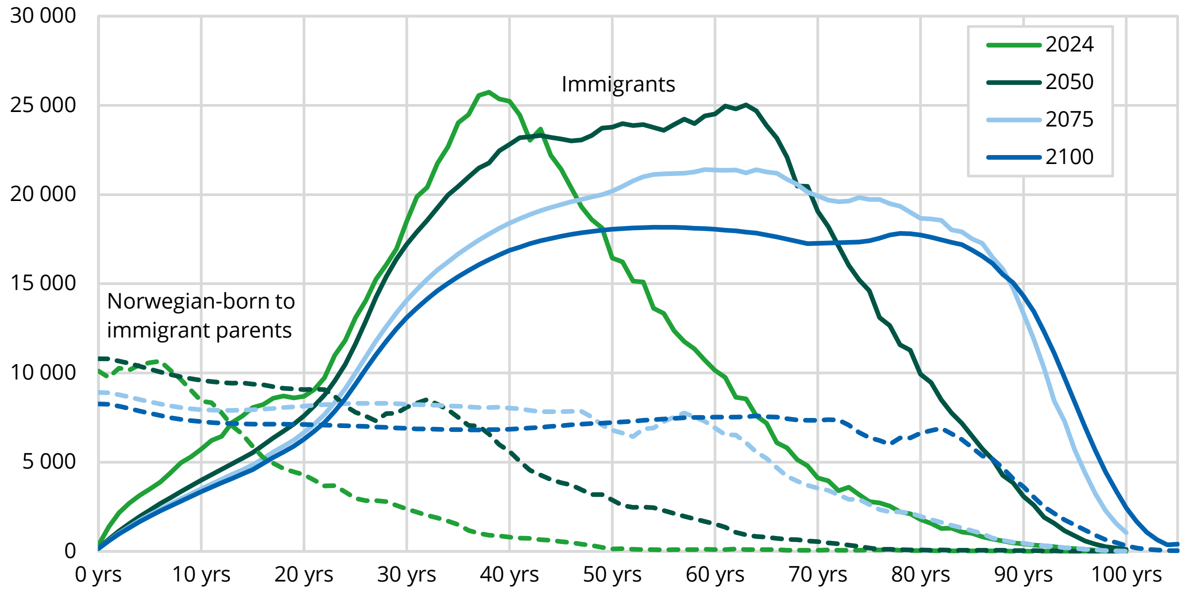
Figure 7.34 Immigrants in Norway by duration of stay, registered 1970–2024 and projected 2025–2100, main alternative (MMM)[1]



[1] The population estimates refer to the population on 1 January.
Source: Statistics Norway

In line with the gradual shift to a more established immigrant population with longer durations of stay, the number of immigrants in older ages is expected to rise. The projected rightward shift in the age profile of the immigrant population is shown in Figure 7.35. In the main alternative (MMM), population growth among immigrants in Norway is confined to age groups above 40 years in 2050, and above 50 years by 2100. Today, most Norwegian-born to two immigrant parents are young, as indicated by the dashed green line in Figure 7.35. The main alternative expects there to be a similar number of young children in this group over the coming decades, but considerable growth in the working ages and older ages.

Figure 7.35 Immigrants (solid lines) and Norwegian-born to two immigrant parents (dashed lines) by age, registered 2024 and projected in 2050, 2075, and 2100, main alternative (MMM)



Source: Statistics Norway

7.12. Summary

From the record levels of immigration in 2022 and 2023, we assume an initial decline in immigration in the main alternative to 76 000 in 2024 (low 53 000, high 94 000) and 64 000 in 2025 (low 45 000, high 88 000). Thereafter, the yearly immigration to Norway in the medium alternative is assumed to be around 50 000 in 2030 (low 40 000, high 60 000), 45 000 in 2050 (low 30 000, high 65 000), and 40 000 in 2100 (low 15 000, high 90 000). Projected emigration depends partly on immigration. In the main alternative, we project relatively stable emigration levels, from around 32 000 in 2023 to around 31 000 per year by 2050.

As with gross immigration, we project net migration to decline from the recent historical highs of 58 000 in 2022 and 53 000 in 2023. In the main alternative, we project a net immigration of around 41 000 in 2024 and around 16 000 in 2030. From 2050 onwards, we assume net immigration to stabilise at around 13 000 per year. In the low immigration alternative, we project a more pronounced decline in net immigration, from around 19 000 in 2024 to around 9 000 in 2030 and around 5 000 in 2050. The high immigration alternative projects an initial increase in net migration to around 59 000 in 2024. By 2050, we assume an annual net immigration of 28 000 in the high immigration alternative.

In our main alternative, the number of immigrants in Norway increases from 931 100 in 2024 to more than 1.3 million by 2050, while the number of people born in Norway to two immigrant parents increases from 221 000 to 430 000 over the same period. The immigrant population in the future is expected to be more established than today's population, with typically long durations of residence and with most growth taking place in older age groups.

8. Uncertainty and sources of error and quality

A population projection can be defined as 'calculations which show the future development of a population when certain assumptions are made about the future course of population change, usually with respect to fertility, mortality, and migration' (United Nations 2018). Population projections show how populations would develop provided that the assumptions on fertility, mortality, and migration remain true over the projection period. In other words, population projections answer the question: What would the size and structure of the population look like if the assumptions hold?

The usual time horizon of population projections is a few decades ahead, up to a century. The Norwegian national projections project the population up to and including 2100. However, as the uncertainty increases substantially with time, we primarily focus on the period up to 2050 in most of our communication.

Various alternatives are normally created in population projections, showing different trajectories for possible future developments. The different alternatives are based on assumptions about future developments, usually formulated for three demographic components: Fertility, mortality, and migration. As such, population projections are a type of 'what-if' analysis, providing different trajectories for future development (Eurostat 2018, United Nations 2018).

Population projections are not the same as population forecasts. A population forecast aims to provide users with what is believed to be the most plausible development of a future population size and composition, while population projections can seemingly contain implausible and purely theoretical alternatives, e.g., no migration or constant life expectancy. Other relevant concepts include plans, which are used for a desired development, and scenarios, which are used as a description of a possible development, policy or action plan linked to certain assumptions (de Beer 2011).

A key purpose of population projections is to help society understand population dynamics and contribute to public debate on future social change. However, they can also prove useful as a starting point for policy discussion and public planning. They may even affect change if, for instance, the projected developments are deemed undesirable. The future is not only something to be discovered, but it can also be viewed as something to be created (Romaniuk 2010).

Estimates of future populations are inherently uncertain. This applies to the size of a future population as well as its changing composition. While uncertainty increases with time, population structures are normally associated with a large degree of persistence characterised by demographic momentum. After all, most of the population will be one year older and have remained in their locations by the next year. As such, projecting the population can prove to be more fruitful and reliable than predicting or forecasting more volatile trends associated with economic dynamics, structures, and events. With that said, despite the relatively good performance of population projections within limited time horizons, their accuracy is affected by the unpredictability of events such as wars, economic crises, health crises, and natural disasters. For example, the sudden surge in the number of births (the post-war baby boom), and its abrupt end two decades later (the baby bust), was largely unforeseen (United Nations 2018). The COVID-19 pandemic presented a compelling example of the implications that global health crises can have on both the national and global economy, freedom of movement, and the everyday behaviour of individuals. The ongoing war in Ukraine is a case in point of the implications of war on the international flow of refugees and the uncertainly of the scale and duration of such flows, as well as the timing and scale of possible returns.

As such, there will always be discrepancies between the projected and the registered total population as well as among the population subgroups. The main reason for this is that we cannot be sure of the future development of fertility, mortality, or international migration, let alone how they might interact. For the total population, immigration has typically been the largest source of uncertainty in recent projection rounds. However, fertility, mortality, and emigration can also end up rather different from what was projected, as illustrated in the previous chapters. In recent years, mortality has declined steadily and thus the impact on errors in the projections has usually been minor. For the respective cohorts, the uncertainty is greatest for those not yet born, as we need to make assumptions about future fertility, while immigration and emigration will also affect their size, at least in young and working ages. Lastly, we know that the uncertainty of estimates of the future population and its composition increases the further into the future we project.

Discrepancies in percentages are typically greatest for smaller groups (e.g., various immigrant groups) broken down by age and sex. The calculated population figures for smaller groups should therefore be interpreted more as trends rather than as a reflection of precise numbers.

In this chapter, we will review three main sources of uncertainty: demographic assumptions, model specifications, and official statistics. Then we will briefly describe our ongoing quality assurance work, before concluding with a description of the factors we consider relevant for producing and publishing high-quality population projections.

8.1. Assumptions about the demographic components

There is marked uncertainty about whether the assumptions used in making the population projections will accurately reflect future demographic trends. This uncertainty is referred to as ‘uncertainty of the future’. This type of uncertainty increases with time. It includes uncertainty about whether events will occur, such as the implementation of policies affecting demographic levels and trends.

Projection results are driven by assumptions that are used for each of the demographic components. This is demonstrated by the discrepancies in the results from the different alternatives in Statistics Norway’s projections, as well as in the differences between our projections and those produced for Norway by Eurostat (2023) and the United Nations (2022).

Before a new set of projections is made, analyses are conducted on historical trends and possible future developments in fertility, mortality, immigration, and emigration. These analyses are discussed by researchers in the respective fields, both within Statistics Norway and externally. The process of determining the assumptions is discussed in more detail in Chapters 5-7. Assessments of projection accuracy show that, over the past decade, immigration has been the most difficult component to project. However, fertility, mortality, and emigration can also be very different from what was projected (Thomas et al. 2022).

To illustrate the uncertainty inherent in population projections, alternative assumptions are made for the three main components: Fertility, life expectancy, and immigration. Each projection alternative is described by three letters: M for medium; L for low; H for high. In addition, we use C for a constant life expectancy alternative and a constant immigration alternative, E for a zero net migration alternative, and 0 for a no migration alternative.

Our main alternative is denoted by MMM, reflecting the fact that the medium-level assumption is used for all components. LLL and HHH denote low and high national population growth alternatives, respectively. These latter alternatives are, however, considered less realistic, as all components are projected to take on relatively extreme values throughout the entire course of the projection period. To demonstrate how the age structure may be affected by different developments in the various components, we also provide alternatives for strong (LHL) and weak (HLH) ageing. While some assumptions are more plausible than others, those that are less plausible can nevertheless prove useful as a hypothetical for use in policy-driven discussions. It is also possible that certain alternatives prove more useful in the short-term than the main alternative, for instance in cases where an unforeseen event has pushed one or more components higher/lower than was otherwise assumed.

As stated, the different assumptions may be combined in different ways to produce different alternatives with differing degrees of plausibility. What characterises all of the alternatives is a smooth development. For example, we do not assume extreme highs and lows in immigration from one year to the next, although this does often happen. Since we have little information about these short-term fluctuations, we choose to project a smooth trajectory that cuts through irregularities. Such assumptions will in themselves be unrealistic, but the idea is that the negative and positive fluctuations will balance out in the longer term. We can of course make short-term *ad hoc* adjustments for ongoing events, as we have this year in response to the ongoing war in Ukraine.

8.2. Model specifications

Structural uncertainty refers to uncertainty related to limitations in our understanding of population dynamics and in our capacity to model them (United Nations 2018). Models are simplifications of reality and as such they may only capture a few key mechanisms. This means that there are a multitude of processes and dynamics that affect population development, and which are not considered. A strength of the national population projection model, BEFINN, is that it decomposes the population according to immigrant characteristics and durations of stay. Other characteristics that may affect demographic behaviour, but that are not accounted for, include: Education, health, and household composition.

The official Norwegian population projections are deterministic and do not generate formal uncertainty estimates and prediction intervals. As such, we cannot quantify the statistical uncertainty associated with the different alternatives resulting from the projections. With that said, a stochastic projection based around the deterministic main alternative was produced as an additional product in Syse et al. (2020). A similar assessment of the reliability of projections of the size and composition of the immigrant population and their children was produced by Keilman (2023). For additional comparisons, interested readers are referred to Keilman et al. (2002) and Foss (2012).

The deterministic approach to assessing and communicating uncertainty, e.g., via the publication of multiple alternatives, has often been viewed as unsatisfactory (see Keilman et al. 2002, Romaniuk 2010, de Beer 2011). The main limitations voiced include the inability of deterministic approaches to:

- Adequately reflect the uncertain nature of population projections
- Provide a probabilistic interpretation of the results of deterministic alternatives, because no probabilities are associated with the different parameters of the inputs
- Modify the width of the high–low interval for some specific purposes, without revising the specification of the alternatives

These characteristics may limit the usefulness of deterministic variants for planning purposes. On the other hand, the publication of multiple deterministic alternatives underlines the fact that the future does not have just one possible path. It also provides a simple way to communicate the plausible range of future demographic trends given what is currently known (Romaniuk 2010).

8.3. Errors in official statistics

The third source of uncertainty relates to the inaccuracy of the data used to construct the projection, such as the baseline population and the observed rates used to inform the assumptions. The population statistics on which the population projections are based comprise persons registered as resident in the National Population Register, i.e., persons who live in Norway permanently or who intend to have their fixed place of residence in Norway for at least six months and who are legally residing in Norway. Nordic nationals have been granted residence permits automatically since 1956. The same now applies to nationals of EFTA/EEA countries. There are some people living in Norway who are not included in the statistics, for instance, seasonal workers or people staying in Norway without a permit. Consequently, it is the *de jure*, and not the *de facto*, population that is projected.

Norway has administrative registers covering the entire population. The registers are up to date and generally considered to be of high quality. Consequently, errors from official statistics constitute a minor source of error in the projections. Such errors nevertheless exist. One example is the delay in the registering of emigrations in the National Population Register, as there are few incentives for individuals to notify the authorities of their departure (Pettersen 2013; Krokedal et al. 2024). The implication is that some people who no longer live in the country remain in the register. Such issues create a discrepancy between the actual and the registered population at the national level, but also impact on the age structure and death rates.

8.4. Quality assurance

We employ several methods to assure the quality of the Norwegian population projections. In short, we review past trends in fertility, life expectancy, immigration, and emigration. We also evaluate previous short- and long-term projections (Thomas et al. 2022), and compare the projections produced by Statistics Norway with those produced for Norway by the United Nations and Eurostat. To ensure transparency, we document the data and methods we employ. We publish the results from 15 alternative projections and emphasise the uncertainty associated with population projections. Since 2020, we have also provided stochastic projections to formally assess uncertainty in future population size and structure. Finally, we examine the degree to which the various results we publish are used and attempt to clarify issues that arise from interaction with end-users.

Historical evaluations

Repeated comparisons of projected values with historical estimates reveal the limitations of population projections and inform users about what can reasonably be expected from them. Engaging in this exercise also enables Statistics Norway to reflect on the source of past inaccuracies, serving as a basis for improving future projection assumptions and methodologies.

The quality of the projected figures is evaluated by comparing the projected results with registered population figures for subsequent years as they become available. We also compare our projections with earlier projections. We do this for both the individual components and the different estimates that result from the models. As an example, we investigate how the projected fertility rate compares to the registered fertility rate, but we also examine the number of projected and actual new-borns as well as deviations in these figures. Longer-term evaluations of national projections are also available for projections published in the period 1969-2000 (Keilman and Pham 2004) and 1996-2018 (Thomas et al. 2022).

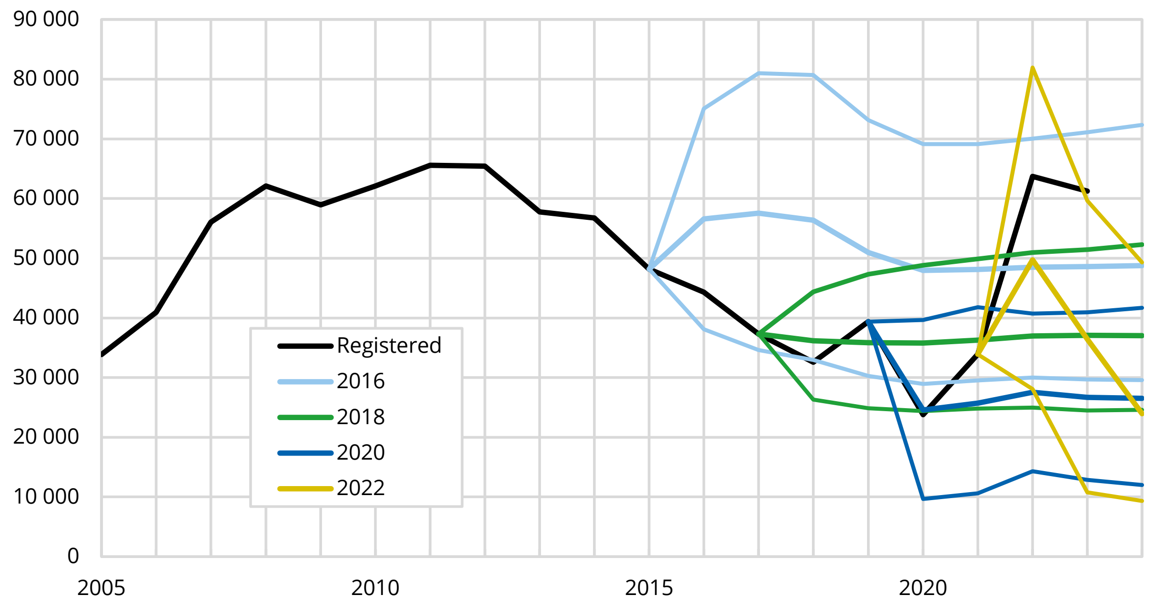
Table 8.1 provides a summary of the short-term discrepancies between Statistics Norway's 2022 projections and the registered population in 2023. Net migration was the source of the largest discrepancy between registered and projected figures, wherein we underestimated the figure by more than 28 000 in the main alternative. The high national growth alternative was closer to the real number but was still more than 12 000 too low. The primary source of this was an underestimation of immigrations, which emerged from a larger number of displaced persons from Ukraine arriving in 2022 and 2023 than was projected. The discrepancies in births and deaths are far smaller. As a result of a lower than projected TFR, the projected number of births in the main alternative was 2 600 higher than observed 2023. The projected number of deaths in the main alternative was 1 500 lower than registered. The low national growth alternative was closer, with a deviation of just 150 deaths.

Table 8.1 Short-term comparisons of the 2022 national population projections, projected and registered figures for 2023 in three alternatives[1]

	Births	Deaths	Net migration	Pop. growth	Pop. Dec 31
Registered	51 980	43 803	52 578	61 219	5 550 203
Main (MMM)	54 600	42 300	24 200	36 400	5 511 400
Low national growth (LLL)	47 700	44 000	7 000	10 800	5 464 200
High national growth (HHH)	60 100	40 800	40 300	59 600	5 566 900
Deviation (MMM)	2 606	-1 492	-28 415	-24 775	-38 769
Deviation (LLL)	-4 277	156	-45 531	-50 428	-86 045
Deviation (HHH)	8 133	-3 050	-12 290	-1 574	16 648

[1] The actual numbers for births, deaths, and net migration do not sum exactly to the population growth figures. As such, population growth is defined as the change in population size from 1 January one year to the same date the following year. Rounded figures are shown for projected numbers to underscore the uncertainty. However, all deviations are calculated using exact projected and registered figures.
Source: Statistics Norway

Figure 8.1 Short-term annual population growth in three alternatives, registered and projected in three alternatives, 2005-2024[1]



[1] The three alternatives are main, low national growth, and high national growth.
Source: Statistics Norway

Figure 8.1 presents the discrepancies between registered and projected population growth. It compares three alternatives (main, high national growth, and low national growth) produced during the last four projection rounds (2016, 2018, 2020, and 2022). The period 2020-2024 has been especially difficult for producers of projections. In 2020, we experienced unprecedented restrictions on travel and daily living, which greatly affected migration patterns, and to a lesser extent fertility and mortality. In 2022 and 2023, we observed record levels of immigration due in large part to the substantial number displaced persons arriving from Ukraine. The 2018-2022 projections performed reasonably well in their first projected year, but the large spike in population growth in 2022 exceeded even the high national growth alternatives of the 2018 and 2020 projections, while the registered level of growth in 2023 exceeded the high national growth alternative of the 2022 projection round. The high national growth alternative from the 2016 projections captured the real level of growth in these years but the main alternative substantially overestimated population growth in all the years prior. If the demographic shocks associated with COVID-19 and the war in Ukraine had not occurred, the 2018 projection may have provided a reasonably accurate picture of the short-term development of population growth in Norway.

Documentation of data, methods, assumptions, and models

Transparency is a vital part of assuring quality in the population projections. Our goal is to make it easy for users to find information and documentation about our population projections. Our website includes links to data in Statistics Norway's StatBank, both for current and previous projections. We create publications such as this report, which show the assumptions as well as the methods used to project them. These are published both in Norwegian and English. Although our primary users are Norwegian speakers, from the perspective of transparency, it is important that we publish our methods, assumptions, and results in English (United Nations 2018, Eurostat 2018). This enables international end-users and/or researchers an opportunity to provide feedback on our work, which also contributes to quality assurance.

User orientation

We attempt to foster a relationship with our users. Users of the projections should perceive our numbers as relevant, and we strive to provide numbers that coincide with their needs. Users can download all the figures we produce via the StatBank (https://www.ssb.no/en/folkfram) and we can be contacted via the national population projection email (nasjfram@ssb.no).

8.5. Quality in the population projections

The quality of population projections is dependent on a multitude of factors. At Statistics Norway, our work to ensure the production and publication of high-quality population projections is guided by the following factors:

- **Independence, integrity, and transparency**: Our population projections should be based on research, i.e., empirical analyses of the forces underlying demographic change. This is partly safeguarded through our contributions to the international population projection environment, and we aim to produce transparent and well-documented projections in both Norwegian and English. This also includes communicating the uncertainty about projected numbers.
- **User orientation, accessibility, and relevance**: We provide timely and detailed information on the Norwegian population (up to and including the year 2100) by one-year age group, sex, immigrant country background and duration of stay. We refer to the alternative that comprises the medium level of all components as the 'main alternative'. We nevertheless guide users who have specific hypotheses in mind to also consider other alternatives. As we publish multiple deterministic projection alternatives, we encourage users to consider a range of projection results rather than a single result, by comparing multiple alternatives.
- **Accuracy**: We strive to employ realistic assumptions in our main alternative, both in the short and long term, based on the knowledge available at the time of projection. The accuracy of previous projections is evaluated regularly in order to highlight areas where improvements may be warranted. Lastly, we monitor the actual population change continuously, and should the future development differ to the assumptions in our main alternative, we guide users as to which of our alternatives diverge the least from actual population figures, explaining why our main alternative may not be the best option depending on their intended use.

Whereas inaccuracies in the short term are likely to emerge from either faulty assumptions and/or unpredictable trend shifts, inaccuracies in the longer term may emerge from different sources. Long-term projections may be used to amend policies to avoid certain future population developments and/or changes. If projections have been used as a political tool to strive for a different population development, inaccuracies between the projected and registered population size and structure are viewed, from our side, as unproblematic. Furthermore, our projections are not a reflection of a sought-after future development.

8.6. Summary

Population projections are intended to serve as a basis for better decision making. Independence and impartiality in population projections are vital to fulfilling this role (United Nations 2018). Users of population projections expect results that are independent and impartial, and these are principles that are followed by Statistics Norway. The accuracy of a projection depends on many factors that are difficult, if not impossible, to anticipate. In this chapter, we have described three types of uncertainty: i) uncertainty of the future; ii) structural uncertainty; and iii) uncertainty related to the data. In the Norwegian setting, 'uncertainty of the future' is considered to have the greatest influence. As such, we choose to end this chapter by reminding ourselves and our users that Statistics Norway's projections do not describe an inevitable outcome – they merely show how the Norwegian population would develop according to the assumptions used for fertility, mortality, and international migration.

9. Conclusions

The 2024 national population projections show a declining rate of population growth, strong population ageing, and a larger, more established, and older immigrant population. According to the main alternative, the Norwegian population will increase from around 5.55 million today, to 6 million in 2040 and above 6.2 million in 2100. We expect more births than deaths up to 2045, after which the situation reverses, and population growth comes to be driven by immigration alone. The immigrant share of the population is projected to increase from just under 17 percent today, to around 22 percent by 2050. At the same time, the future immigrant population will also be more established, as immigrants age in place and their durations of residence increase. This aligns with a broader trend of strong population ageing in Norway. During the next decade, the population will be composed of more older persons (65+ years) than children and teenagers (0-19 years). As a group who tend to be major users of health and care services today, the population aged 80 or older is expected to more than double by 2050 and is projected to comprise almost one million individuals by 2100.

Our medium assumption for fertility (low and high in parentheses) is that the total fertility rate (TFR) will gradually increase from today's historically low level (1.40 children per woman) to 1.44 in 2025 and 1.57 in 2030. In the longer run, TFR is assumed to stabilize at around 1.66 (low 1.21, high 1.91). Life expectancy is assumed to increase throughout the century, albeit to a lesser extent than in the previous projection round. For men, the medium life expectancy assumption projects an increase from 81.4 years in 2023, to 86.0 (low 83.3, high 88.4) years in 2050 and 92.1 (low 87.3, high 96.3) years in 2100. For women, an increase from 84.6 years in 2023 to 88.3 (low 85.9, high 90.5) years in 2050, and 93.4 (low 89.0, high 97.3) years in 2100, is assumed. Immigration in the short term is expected to be lower than in 2022 and 2023, but still high from a historical perspective due to the anticipated arrival of Ukrainian refugees. In the medium assumption we assume that immigration to Norway will decline from 85 000 in 2023 to 76 000 in 2024 (low 53 000, high 94 000). Thereafter, the immigration assumptions settle on more stable long-run trajectories, with gross immigration assumed to be around 64 000 (low 45 000, high 88 000) in 2025, 49 000 (low 39 000, high 59 000) in 2030, 44 000 (low 30 000, high 66 000) in 2050, and 40 000 (low 15 000, high 88 000) in 2100. The projected emigrations depend partly on the immigrations. In the main alternative, we project a decline in net immigration from around 41 000 (low 19 000, high 59 000) in 2024, to around 16 000 (low 9 000, high 24 000) in 2030. From 2050 onwards, the main alternative assumes net immigration will stabilise at around 13 000 per year.

Population projections are inherently uncertain. Uncertainty usually increases the further into the future we look, with the greatest uncertainty being associated with smaller population sub-groups and those who are not yet part of the population. Future immigration is subject to the most pronounced degree of uncertainty, but trends in fertility, mortality, and emigration can also end up rather different than expected. As with the 2022 projection round, the ongoing war in Ukraine means that uncertainty, at least in the short term, is more pronounced than usual.

For more information about the population projections, see https://www.ssb.no/en/folkfram. Detailed figures for the registered and projected population are available in Statistics Norway's StatBank, see https://www.ssb.no/en/statbank/list/folkfram.

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Appendix A: Description of country groups

Country Group 1: Sweden, Denmark, Finland, Iceland, Faeroe Islands, Greenland, United Kingdom, Ireland, Isle of Man, Channel Islands, Netherlands, Belgium, Luxembourg, Germany, France, Monaco, Andorra, Spain, Portugal, Gibraltar, Malta, Italy, Holy See, San Marino, Switzerland, Liechtenstein, Austria, Greece, Cyprus, Canada, United States, Bermuda, Australia, and New Zealand.

Country Group 2: Estonia, Latvia, Lithuania, Poland, Czechia, Slovakia, Hungary, Romania, Bulgaria, Slovenia, and Croatia.

Country Group 3: All remaining countries, i.e., those in Africa, South and Central America and the Caribbean, Asia (excluding Cyprus), Oceania (excluding Australia and New Zealand), and all non-EU member states in Eastern Europe. Stateless people are included in this group.

Statistics Norway's comprehensive classification of grouping of countries and citizenship can be found here: https://www.ssb.no/en/klass/klassifikasjoner/91/om.

Some aggregations are required to achieve the country groups employed in the projections:

Country Group 1 = G00 + G11 + G12 + G14 + G15

Country Group 2 = G13

Country Group 3 = G2 + G9

List of figures

List of tables