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Iceland's demographic transition: from turf houses to too many tourists

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Research Article

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Abstract

Iceland was one of the last places in Europe to be settled. It thus has a relatively short population history as it was completely depopulated until about 871. Harsh climatic conditions, periodic epidemics, and numerous natural disasters were not conducive to robust population growth on the island. This article traces the demographic transition of Iceland's population from the initial settlement to the present. This is the transition from high to low birth and death rates as a population modernises. Iceland has an impressive literary and historical record-keeping tradition beginning with the Saga Age in the 900s. It also has long had a well-developed statistical system which allows the study of population trends much further back in time than many countries. The results show slow population growth for much of Iceland's history with many episodes of steep population decline. A series of technological innovations in the 19th century allowed the country to modernise, the population to grow, and its demographic situation to improve. Iceland has completed the demographic transition, the population is growing, in part due to high immigration, and it has some of the best demographic indicators in the world. Despite these favourable trends, the country faces some demographic challenges.

Introduction

Iceland is a geologically young island and was completely depopulated until about 871 (Hjalmarsson, 2007, p. 9). It was one of the last places in Europe to be settled by humans. People continued to migrate to the island for the 60 years after the first settlers. From this initial cohort, the population endured harsh climatic conditions, epidemics, famines, and more natural disasters than most countries typically face. Despite this inauspicious start, 11 centuries after the initial peopling of the island, the Icelandic population has developed into a modern society and one of the most prosperous countries in Europe and the world. Iceland has long time series of population data available from the 1700s to be able to monitor the country's demographic transition. Prior to this, proxy sources can be used to discern demographic processes back to Iceland's initial settlement. This article uses indirect estimates and population statistics to trace the demographic transition of Iceland as it modernised, through to the second demographic transition which the country is now in.

Iceland was discovered and settled by Norsemen in the late 9th century. About three-quarters of early settlers were Scandinavian and one-quarter from Scotland and Ireland (Ogilvie, 2005). Following the first small group, others followed during what is termed the Age of Settlement, which lasted to about 930. People emigrated from Norway and other countries to Iceland because of shortages of land and other reasons. Many of the push factors lessoned and immigration to Iceland ceased after 60 years. A separate, distinct nation began to form, with a common identity and language, and later a common religion. It would only be centuries later, in fact quite recently, when there would be any significant immigration to Iceland resulting in diversification of this previously extremely homogeneous population. If the estimate of 50,000 persons living in Iceland at the end of the settlement period is correct (Karlsson, 2020, s. 15), the country would not reach this population size again for nearly a millennium.

Following this introduction, this article is divided into five parts. The first describes the theory of demographic transition and how it is applied to Iceland. The second explains the proxy and statistical data used to examine population trends in Iceland. The third provides a broad overview of the history of human habitation of Iceland from the time of its initial settlement until the 18th century using indirect estimates and information on factors impacting the population. The fourth analyses the demographic transition in Iceland starting in the 1700s when population data became available allowing more precise measurement of demographic trends. A final section concludes with discussion of the second demographic transition that the country is now in and some of the demographic dilemmas it faces.

Demographic transition theory

There have been several histories of Iceland which have been written including a few in English (Karlsson, 2020; Karlsson, 2000; Hjalmarsson, 2007). Most of these include population totals and discuss their veracity but not other demographic indicators. This study compiles population statistics and demographic indicators for the country to analyse its transition to becoming a modern society. The demographic transition theory has been the dominant one in demography for much of the past half-century (Notestein, 1945). The theory is derived from modernisation theory to describe the transition that societies undergo as they move from traditional to more modern societies. Demographically, this is the transition from high birth and death rates, where there is little control over fertility and mortality to a situation where there is increased control over fertility through modern contraception and deaths from communicable and infectious diseases have been reduced. The demographic transition is typically divided into four stages. The first being a period when both births and deaths are high and where there is little control over either fertility or mortality. The second stage is when there is increased control over mortality and the death rate begins to decline, while birth rates remain high leading to a period of rapid population growth. The third stage occurs when there is a response to the lower death rates through lower and controlled fertility. The fourth stage occurs when both birth and death rates stabilise at lower levels, leading to lower rates of population growth or even population decline.

The demographic transition is accompanied by several other transitions which occur simultaneously as societies modernise (Weeks, 2008). Most often, the first to occur is the health and mortality transition, which is the shift from deaths to infants, children, and mothers where communicable diseases are the most common cause to degenerative and lifestyle causes of death being dominant and deaths occurring at older ages. This is typically followed by the fertility transition which is the shift from high and uncontrolled to low and more controlled fertility. The fertility transition typically occurs in response to the mortality transition where to achieve an ideal family size, less children need to be born because a higher share survives until adulthood. These two transitions lead to an age transition with an older average age and relatively more people in the older ages than in younger age groups. As there are structural changes in an economy, there becomes an oversupply of people in rural areas which leads to the migration transition. This mostly consists of young adults moving from rural areas to urban areas. This then leads to the urban transition where people are born, work, and live in urban areas. Another transition is the family and household transition of smaller families and postponement of marriage brought about by the other related transitions which impact society and economy.

Demographers have proposed a second demographic transition in countries that have completed the first (Lesthaeghe, 2014). This includes below-replacement fertility rates, increased cohabitation, and childlessness. It was originally thought that when countries completed the first demographic transition, they would stabilise at replacement-level fertility with nuclear families. In the 1980s, demographers observed that countries did not follow this pattern. The reality in many higher-income countries has been lower fertility and a multitude of living arrangements. This trend has been brought about by shifts in attitudes stressing individuality and other factors such as advances in contraceptive technology (Zaidi & Morgan, 2017). The Nordic countries, including Iceland, are often seen as the forerunners in demographic behaviour (Hellstrand et al., 2021). Since 2010, this has included declines in fertility to new low levels, while fertility in the rest of Europe has stabilised.

Data and methods

Iceland has an impressive literary and historical record-keeping tradition beginning with the Saga Age in the 900s. There is also good climate data which is helpful in assessing the impacts on a population engaged primarily in agriculture. It has also long had a well-developed statistical system which allows the study of population trends much further back in time than many countries. This valuable record-keeping is especially crucial for analysis of trends during Iceland's demographic transition. Starting in 1735, church records of births and deaths began to be collected in all parishes (Statistics Iceland, 1997). The first records of births and deaths began to be published annually in a journal in the years 1786–1796. Starting about 1881, police authorities and town councils became responsible for annual town censuses rather than the clergy. The annual parish censuses were discontinued when the National Register of Persons within Statistics Iceland was founded in 1952, and this provided a uniform, centralised registration of the entire population, including by settlement for the entire country. The register is a now a computerised database that tracks each person domiciled in Iceland. A useful source of historical statistical data about the population, society, and economy is *Sögulegar hagtölur um Island* (Icelandic Historical Statistics) (Statistics Iceland, 1997).

The world's first complete population census of an entire country, including the recording of all names and ages, was conducted in Iceland in 1703 (Karlsson, 2020). The next census was conducted in 1769 as part of the general census of the Kingdom of Denmark, though it did not include names, only the number of inhabitants in each parish by age and sex. To investigate the economic status of the country following famine and devastation resulting from the volcanic eruption in 1783–1784, another census using the same principles was conducted in 1785. Another census conducted by the Kingdom of Denmark in 1801 included Iceland. From 1835 to 1860 censuses were conducted every 5 years and every 10 years since then. They include more detail the closer to the present. The results were published in Danish. Starting in 1910, the censuses were conducted exclusively in Iceland by the Department of Finance and later by Statistics Iceland, which was founded in 1914. Censuses were conducted every 10 years from 1910 to 1960 and then again in 1981 after an interval. Since then, no censuses were conducted as the population register serves as the main system for keeping population counts. This is like the other Nordic countries which have done away with traditional censuses. Register-based censuses were conducted in 2011 and 2021.

The long period of population stagnation

Precise data are lacking on population size and change for the period from the initial settlement until the first census, at the beginning of the 18th century, and when registration of vital events began in the mid-1800s. However, it appears from indirect estimates that the population fluctuated between 40,000 and 60,000 (Hjalmarsson, 2007, p. 67). Data on population size and change for the 18th century show a continuation of the demographic trends of the previous centuries. For all this period,

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Iceland was in the first stage of the demographic transition with high birth rates and high and wildly fluctuating death rates.

There are quite good, though sporadic, records of the climate, population, and the economy of Iceland during this period (Dansgaard et al., 1975). In recent decades in Iceland, there have been some promising developments in historical climate research through advances in palaeoclimatology (Huhtamaa & Ljungqvist, 2021). Important for historical demographic research in Iceland is improved understanding of the influence of climate–society interactions. Climate data came from early historical writings, mediaeval annals, and geographical descriptions (Ogilvie, 2005). The study of Iceland's history began early in the 12th century (Karlsson, 2020). Some information can be gleaned from the Sagas. These tell us about a volcanic eruption in 1262 and natural disasters in the early 14th century which included epidemics, mortality, and earthquakes (Hartman et al., 2017). Starting in the 18th century, government officials began to gather reports on climatic conditions and to compile charts and maps. These included observations as to the extent of sea ice surrounding Iceland which is an important clue as to overall climatic conditions. Sea ice generally has had a negative impact on production, fishing, and trade. Later, meteorological offices were established, and modern-day observations began (Karlsson, 2000, s. 188). It appears from sources that much of the lowlands of Iceland were forested at the time of settlement, but these were cut down quite quickly and deforestation remains an issue to the present day but must have had a significant impact on the early population. In addition, the animals brought to Iceland by early settlers had a deleterious effect on the environment causing serious soil erosion (Vasey, 1996).

While not everything can be precisely known about population trends in Iceland from the time of its founding to the period of modern data collection, the country is unique in that there are an abundant number of sources about its origin, both written and archaeological (Karlsson, 2000). Two publications provide insight into population developments during the settlement period, the *Book of Icelanders* and the *Book of Settlements*. The first is a rather short report about Iceland's early history. The second is longer, between 100 and 200 pages, and covers the settlements and first settlers throughout the country. The *Book of Icelanders* includes information on the number of farms, 4,560 at the beginning of the 12th century. Based on the average household size at the time, an estimate of 40,000 persons is made (Karlsson, 2000, pp. 44–45). Other sources give a population of 70,000 to 100,000, but this seems rather implausible given that following a relatively warm period during the 11th and 12th centuries, the climate cooled and would remain so until the 19th century, during the five centuries referred to as the "Little Ice Age" (Gudmundsson, 2007, s. 228). Another source conjectures that the pre-modern population maximum of 50,000 to 60,000 was reached in the early 12th century (Hartman et al., 2017).

Reliable measurements of temperature began in Iceland in the mid-1800s, but there are proxy sources which show that Iceland entered a long cool period following the initial settlement which lasted until the early 20th century (Gudmundsson, 2007). Written evidence matches quite closely with information on coastal drift ice and ice core samples from Greenland (Karlsson, 2000, p. 189). This long period of cold climate, in a predominantly agricultural society, support evidence of smaller population estimates. In addition to cold climate, volcanic eruptions also influenced the Icelandic population, of which there have been as estimated 250 or more since settlement. Major eruptions occurred in 1104, 1300, and 1362, which had significant impacts on food production and thus human population growth (Hartman et al., 2017). The Great Plague or Black Death ravaged Europe in the mid-1300s but arrived later in Iceland about 1402 when it was estimated that between one-third and one-half of the population succumbed to the disease (Hjalmarsson, 2007, p. 63). There was a second epidemic in 1494 that also killed between 30 and 50 per cent of the population (Karlsson, 2000, p. 115). Such estimates are derived from information on the number of abandoned farms.

The 17th century was a not a good one in Iceland and ended with several especially bad years in fishing and farming. The Danish crown was so concerned about the dismal situation in Iceland that a committee was established to investigate the social and economic conditions in the country. This included a collection of information about the economy and demography of Iceland, resulting in the 1703 population census. However, the 18th century did not begin well for Iceland. Starting in 1707, there was a smallpox epidemic which resulted in the deaths of over one-quarter of the population, reducing it from 50,000 to 37,000 (Karlsson, 2000, p. 177). There was a period of very cold weather which resulted in a famine causing a population decline from 49,000 to 43,000 between 1751 and 1758 (Statistics Iceland, 1997). Forty-three years in the 18th century were described as dearth years with severe weather, of which 14 resulted in significant loss of human life and domestic animals upon which Icelanders depended (Ogilvie, 2005). The last famine due to climate conditions following a severe winter in 1880–1881, occurred in 1882 (Ogilvie, 2005; Hartman et al., 2017). That in the 17th century the population of Iceland suffered a disaster which reduced numbers each time it reached 50,000 has been pointed to as evidence in support of the Malthusian doctrine of population checks in an agricultural society. However, this is hardly universally accepted. It is accepted that the period from 1600 to 1900 was one of quite harsh climate in the country, making living conditions difficult (Gudmundsson, 2007). Regardless of the cause of these demographic disasters, in the 18th century the Danes made several proposals to improve living conditions in the country (Valsson, 2003). Thus, at the end of the 18th century, living conditions were still quite dismal, the country had not begun to modernise, and demographic indicators were like what they had been for most of its history.

The modern period in Iceland

Until the 1800s, the country remained predominantly agricultural with most families engaged in farming, mostly animal husbandry. There was a confluence of economic, technological, and political events that caused Iceland to begin to modernise, some of these external to the country. These trends had an enormous impact on the demographic growth and development of the country. The most crucial was the modernisation of fishing boats. Foreign countries with larger and higher-quality ships fished in Icelandic waters more than Icelanders themselves. English boats began fishing in Icelandic waters starting in the 15th century, a period of foreign exploitation of Icelandic fishing stocks which would last until the "Cod Wars" in the 1970s when territorial fishing limits were established (Karlsson, 2000, ss. 342–347). Locals were using mostly small, open rowboats which restricted them to day trips near the shore. This was both inefficient but also quite dangerous resulting in high male mortality as men engaged in most of the offshore fishing (see section on sex ratios). In the second half of the 1800s, Icelanders began to acquire larger, decked boats (Hjalmarsson, 2007). This raised productivity in fishing, made it

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safer, and resulted in new villages and towns growing on the sites of fishing villages. This was the beginning of fishing as an important industry as motorised boats and trawlers became more widely used in the first decade of the 12th century. The introduction of decked boats would also lead to the growth of fisherman as a professional class which would have numerous other implications including contributing to the growth of larger coastal settlements. After 1870, the number of decked boats increased significantly and motorised boats were launched in 1902, making fishing both more efficient and safer. Trawlers were introduced in fishing which greatly increased the catches. It was really the mechanisation of fishing in the first decades of the 20th century from which most other aspects of modernisation and increased wealth followed.

A savings banks was established in 1868 to aid in the growth of industry (Hjalmarsson, 2007). Around this time, book and newspaper publishing became more common. Health care began to improve in the late 1800s as well, and the first hospital was founded in Reykjavik in 1866. There were significant improvements in health care after the turn of the century in the form of increases in the number of doctors and their spread to most districts in the country, the eradication of many infectious diseases, and improved sanitation (Dís Skaptadóttir, 2004). Housing in urban areas began to increasingly be constructed of wood or stone rather the turf houses which were common in rural areas.

In 1874, on Iceland's millennium, the King of Denmark visited and brought a constitution which gave the Icelandic parliament increased powers. In 1904, Iceland obtained home rule and the seat of government was moved from Copenhagen to Reykjavik. Among the improvements put in place by the first Icelandic Minister were improvements in transportation and communications, which included the introduction of the telegraph in 1905 and later the telephone. Towards the end of the 19th century, roads began to be built for carriages and more bridges were built across the many rivers. Legislation was introduced in 1894, that divided roads into different categories, which were to be funded by the state treasury (Valsson, 2003, p. 88). The first car was brought to Iceland in 1904 and a decade later, more were brought which ushered in the automobile age, which was now possible with all the roads and bridges which had been built. This facilitated mobility around the country. The ring road was finally completed in 1974. Industry was becoming increasingly mechanised, and there was both growing demand and supply of skilled workers, when technical and academic schools were opened in the 1900s. Thus, at the beginning of the 12th century, Iceland was on a path towards modernisation which was reflected in its demographic profile. Eyeing other Scandinavian countries, Social Democrats began to be dominant politically, laying the groundwork for the future welfare state.

Iceland's demographic transition

The article now turns analysis of the country's demographic transition based on population statistics. The first census conducted in 1703 enumerated a population of 50,358, about the same size as at the end of the settlement period nearly eight centuries prior (Fig. 1). Thus, for this period, population change in Iceland was clearly in the first stage of the demographic transition as the death rate fluctuated considerably due to various epidemics, crop failures, and natural disasters, mostly volcanic eruptions, and periods of extreme cold. During many years over this time, deaths exceeded births, on some occasions by large numbers. In 1756–1758, deaths exceeded births by 5,300 due to the eruption of the volcano Katla in 1755. The years 1784–1786, following the eruption of the volcano Laki, were even more devastating when deaths exceeded births by 10,600 causing the population size to fall below 40,000 for several years. It was estimated between nine and ten thousand people died of starvation because of many animals being killed by toxic gases from the eruption (Hjalmarsson, 2007, p. 93). Due to these disasters, the population remained below 50,000 through the early part of the 1800s. This was compounded by wars in America and Europe which blocked shipping resulting in shortages of many basic goods and restricted exports from Iceland.

The 1801 census enumerated a population of 47,240, a decline of 3,000 over the course of the 18th century. The population size would continue to fluctuate without growing until about 1830. About that time, the population would begin a period of steady growth which continues to the present, as standards of living gradually began to improve. Some of this was brought about by increases in food production, without any improvements in technology. The second half of the 19th century was also a period of a warming climate compared to the first half of the century. The population could be said to have entered the second stage of the demographic transition, and death rates were declining and fluctuating less, indicating that there was increased control over mortality. Birth rates remained high causing the population to increase, reaching 60,000 for perhaps the first time since the end of the settlement period. In 1885, a period of substantial population growth began where natural increase (births minus deaths) would continuously be positive contributing to sustained population increase. The population increased despite a period of significant emigration from the 1880s to the 1910s. The population would reach 100,000 in 1926.

The 12th century was a period of substantial modernisation and increased standards of living in Iceland which resulted in increased population size. Natural increase remained high and was the main factor determining population increase. The population reached 200,000 in 1968 and 300,000 in 2007. By this time, the population of Iceland could be said to have been in the fourth stage of the demographic transition, characterised by low fertility rates, small families, low levels of mortality, and high life expectancy. More on this below, but starting in 2005, there has been substantial immigration into Iceland and has been a major contributor to population increase. The booming Icelandic economy created a demand for foreign labour. There was a period of net emigration for a few years following the financial crisis in 2008, but this was short-lived and there are now again more people coming to Iceland than leaving. At the beginning of 2024, the population of Iceland was 383,726, its highest ever recorded size.

Statistics Iceland has made an adjustment in the population figures because of an overestimation of the population due to an increase in immigration from EEA countries. (Statistics Iceland, 2024b) This showed that the population on 1 January 2024 was overestimated by 15,245 people. Population totals and demographic measures have been adjusted going back to 2010.

Health and mortality transition: Large gains in life expectancy

As discussed in the overview of the demographic transition, the health and mortality transition is usually the first, from which the others follow. This was certainly the case in Iceland. In the health and mortality transition, overall health improves, and the age, gender, and disease patterns of mortality shift. In other words, there are changes in who dies and from what causes. In addition to

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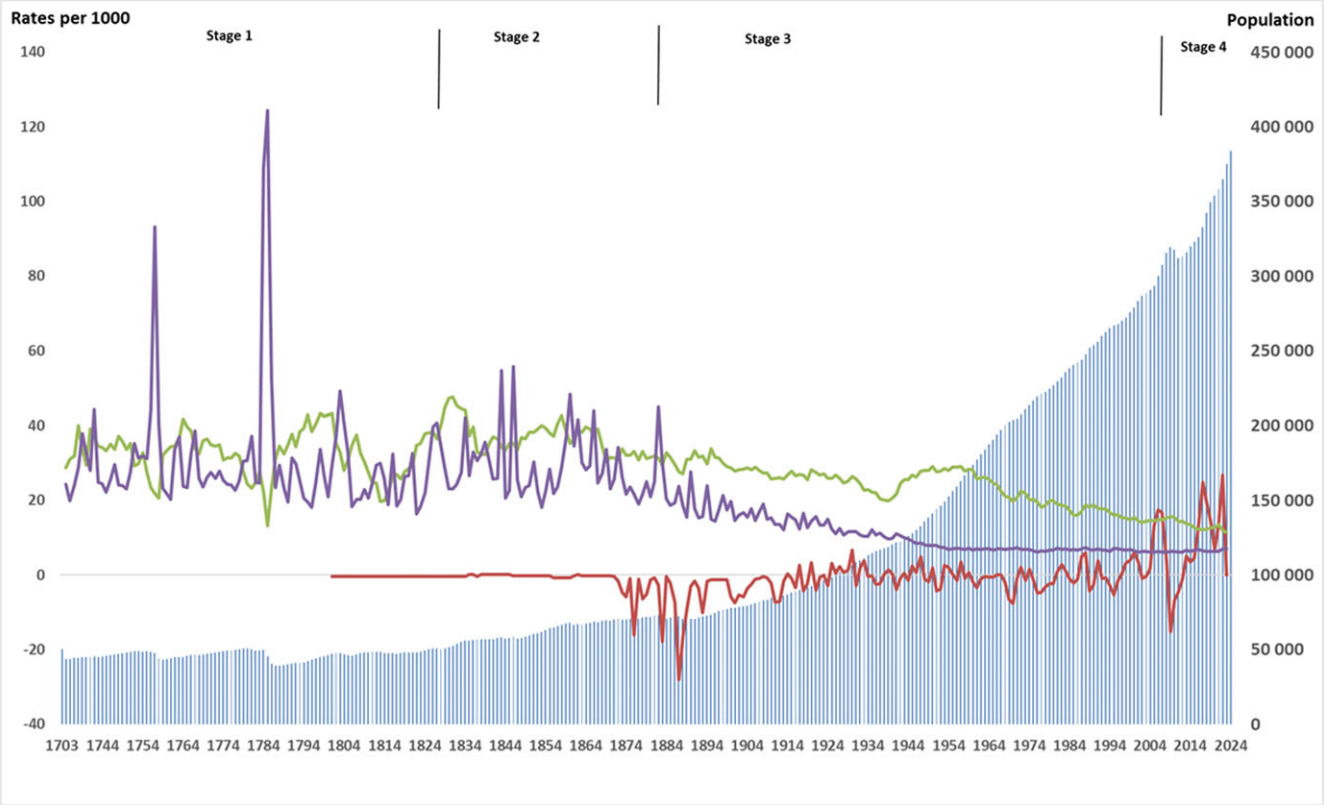

Figure 1. The demographic transition in Iceland, 1703–2024. Source: (Statistics Iceland, 2024c) (Statistics Iceland, 1997).

long time series of demographic data, Iceland is also said to have some of the world's best disease records (Cliff, Haggett, & Smallman-Raynor, 2009). The combination of robust disease data and being an island make it an ideal location for the study of infectious diseases. Data on life expectancy are available for Iceland dating back to 1841, a rather long record compared to other countries (Fig. 2). In 1841–1850, life expectancy at birth was 31.1 for males and 35.5 for females. With a few fluctuations, life expectancy would steadily rise, increasing to above 70 years for both sexes in 1951–1960 and above 80 years for both sexes in 2011. Prior to the COVID-19 pandemic, in 2019, life expectancy was 81.0 for men and 84.3 for women. This placed Iceland with among the highest level of life expectancy in both Europe and the world. In 2015–2020, life expectancy in Iceland for both sexes was 82.8 (United Nations, Department of Economic and Social Affairs, Population Division, 2019). Japan had the highest life expectancy in the world at 84.4 years. Within Europe, only Switzerland, Spain, and Italy had higher life expectancy than Iceland. During the pandemic, life expectancy fell slightly by 0.7 years for males and 0.6 years for females.

There were improvements in mortality across all ages, but what drove the increase in life expectancy was the dramatic reductions in infant mortality (Fig. 3). When records began to be kept in the 1840s, the number of children who died before their first birthday was 3 in 10, with some periods significantly higher, especially during years of severe epidemics (Guttormsson & Garðarsdóttir, 2002; Garðarsdóttir, 2002). Some of this was due to low levels of breastfeeding of infants in Iceland compared to other countries (Guttormsson, 2017). The infant mortality rate would steadily decline through the 19th century, reaching less than 100 infant deaths per 1000 births at the end of the century. There was the eradication or elimination of several causes of childhood death during the 12th century, including polio, diphtheria, measles, pertussis, and scarlet fever (Cliff, Haggett, & Smallman-Raynor, 2009). The rate would fall to less than 10 infant deaths per 1000 births in 1980 and to about 2 infant deaths per 1000 births most recently. In 2019, Iceland had the lowest infant mortality rate in the world (United Nations, Department of Economic and Social Affairs, Population Division, 2019).

Data on mortality by cause extend back to 1911 which accords insight into the changing patterns of mortality during a period of significant change in Icelandic population patterns (Statistics Iceland, 1997). In 1911–1915, the total mortality was 1,425 deaths per 100,000 persons. It would decline by more than half to 687 deaths in 1986–1990. Over this period, deaths from tuberculosis, infectious, and parasitic diseases would decline from 300 deaths per 100,000 persons to just 4.5. Deaths from pneumonia and influenza would also decline from 185 to 59 deaths per 100,000 persons. Declines in these causes of death are brought about by improvements in public health measures and sanitation of which there were many in Iceland during the 12th century. There were also declines in external causes of death from 112 to 35 per 100,000 persons during this period, much of it due to declines in accidents in fishing. Deaths in the category, "senility without mention of psychosis, ill-defined, and unknown causes" declined from 329 to 8 per 100,000 persons, and much of this could be attributed to better classification. There was also a decline in the category "Other diseases" from 257 to 134 deaths per 100,000 persons, also likely from more precise and complete death recording. Deaths from malignant neoplasms (cancer) increased from 101 to 173 deaths

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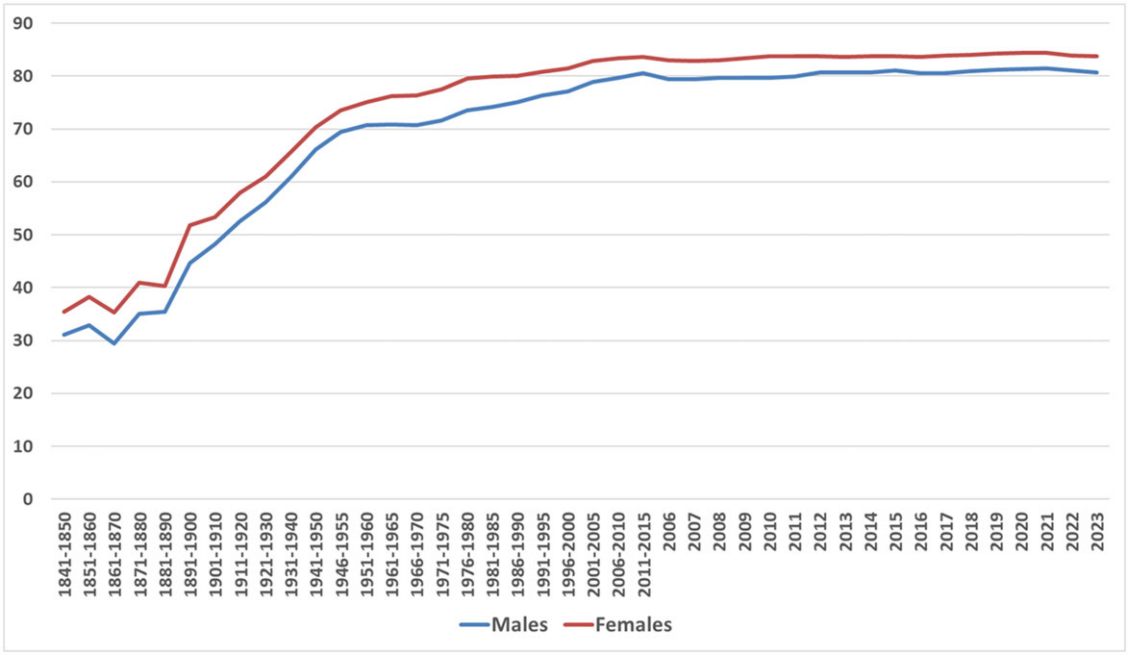

Figure 2. Life expectancy at birth by sex, 1841–2023. Sources: 1841–1970: (Statistics Iceland, 1997). 1971–2019: (Statistics Iceland, 2024c). Data for 1841–1950 are for 10-year period. Data for 1960–2005 are for 5-year periods. Starting in 2006, data are for single years.

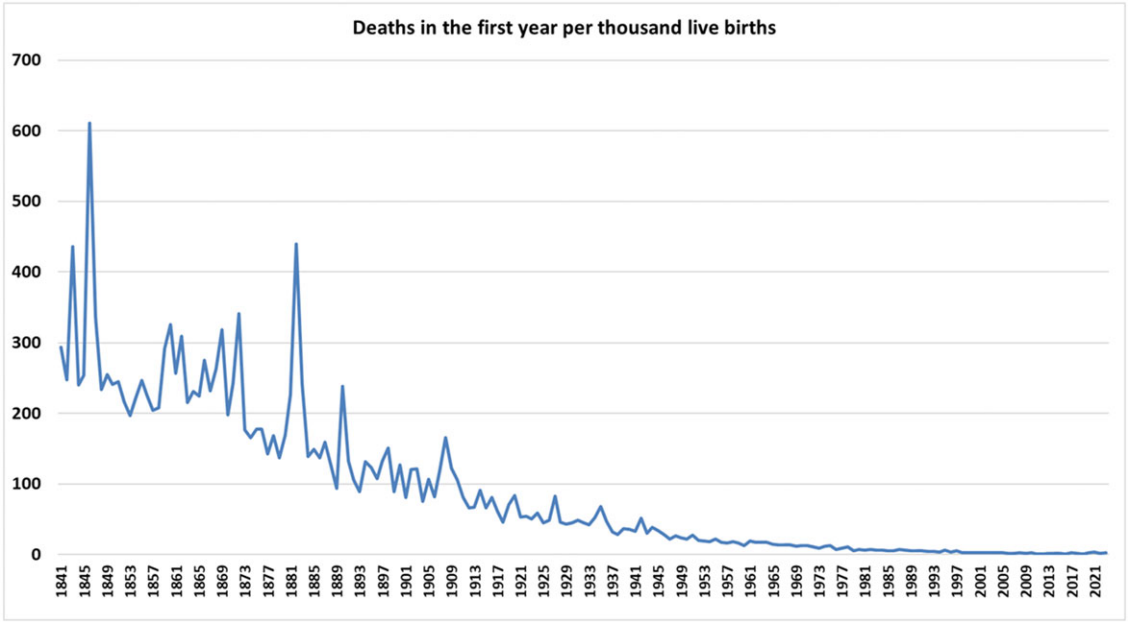

Figure 3. Infant mortality rate, 1841–2023 Source: (Statistics Iceland, 2024c).

per 100,000 and deaths from heart disease increased from 61 to 189 deaths per 100,000. Increases in these latter two categories are consistent with the later stages of the demographic transition where lifestyle and degenerative causes of death become the most common.

There was a new classification of deaths starting after 1990, which shows that the pattern of mortality by cause has not changed very much (Statistics Iceland, 2024c). This is characteristic of a population like Iceland in the latter stages of the demographic transition. Between 1990 and 2020, the total death rate declined moderately from 671 to 634 per 100,000 persons due to a combination of lower mortality and but with an older population. The two broad categories of mortality which contributed to this decline were diseases of the circulatory system (from 294 to 188 deaths per 100,000 persons) and cerebrovascular diseases (from 71 to 33 deaths per 100,000 persons). There has long been a surplus of females in Iceland dating back to the 1701 census when there were 83 males per 100 females (Statistics Iceland, 1997, s. 124). The deficit of males is attributable to excess male mortality throughout the life course (Karlsson, 2020, s. 189). Excess male mortality

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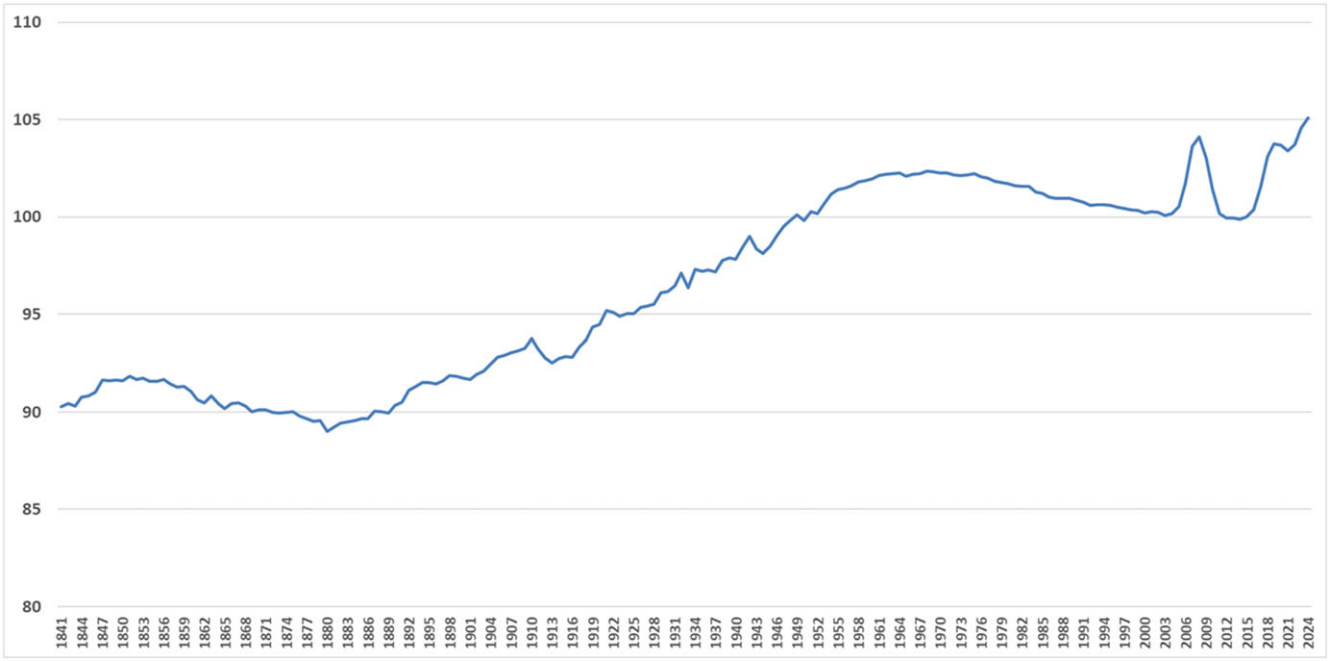

Figure 4. Males per 100 females, 1841–2024. Source: (Statistics Iceland, 2024c).

during this period was caused by the peculiar lack of breastfeeding at early ages (Garðarsdóttir, 2002). During the 19th century and first half of the 20th century, there was still a deficit of males, when there were about 90 males per 100 females (Fig. 4). This was due to much higher male mortality rates especially from accidents, including drownings, in the fishing industry. For instance, in 1861–1865, there were 112 male deaths from accidents and only 10 female deaths. Of these, 98 were male deaths from drowning and only 8 female drowning deaths (Statistics Iceland, 1997).

Over time, the overall number of deaths from accidents declined, most significantly those from drownings as fishing became safer with the introduction of decked and motorised boats and the male:female gender ratio increased so that by 1950, it was equal. A similar trend of low male sex ratios occurred in Greenland for the same reasons (Hamilton & Rasmussen, 2010). Seal hunting and then fishing were activities primarily carried out by men which were quite hazardous. In 1780, Greenland had less than 80 males per 100 females. As fishing became safer with better wooden boats, the male sex ratio improved and reached parity about 1950, the same time as Iceland. The upturn in the male sex ratio in Iceland around 2008 had to do with the influx of mostly male migrant workers employed in several large construction projects. After the 2008 financial crisis, there was a decline in the male sex ratio evidence that predominantly male immigration influences the sex ratio. Following economic recovery, the male sex ratio has increased to currently 105 males per 100 females, perhaps the highest ratio in the country's history.

Fertility transition: Fewer children

Usually, the second demographic transition to take place is the fertility transition which follows the health and mortality transition, with some lag, during which the population grows considerably, as was the case in Iceland. Data to be able to compute the total fertility rate date to 1853, at which time Icelandic women were giving birth to 5.7 children (Fig. 5). The fertility rate would then begin a slow but steady decline. From 1860 to 1915, the fertility rate would fluctuate but usually remain above four children per woman. It would then begin a decline, dropping below three births per woman during the depression years in the late 1930s. There would be a small baby boom in the second half of the 1950s when the fertility rate would rise again above four children per woman. Fertility would then decline again but remain high by European standards remaining at or above replacement level until the past decade. The period from 2009 to 2018 showed a significant decline from 2.2 to 1.7 children per woman, the latter being the lowest recorded fertility rate in Iceland's history (Karlsdottir, Heleniak, & Kull, 2020). There was a slight increase during the pandemic but then a decline in 2023 to a new low of 1.6 children per woman. This decline was like other Nordic countries which also had lowest-ever fertility rates (Heleniak, 2024).

Social conditions precluded marriage so that in 1703, only 26 per cent of men and 21 per cent of women twenty and older had been married (Statistics Iceland, 1997, s. 128). From 1853, when records first began to be compiled, until 1935, between 11 and 20 per cent of births were to unmarried women (Statistics Iceland, 2024c). There were marriage restrictions which were a major curb on population growth (Vasey, 1996). This seems to be a deliberate attempt at population regulation. Starting in 1935, the share of births to non-married women steadily increased and reached more than half in 1985. It has continued upwards and now roughly 70 per cent of births are to unmarried women. In Iceland, and across the Nordics, there are high levels of cohabitation, and many children are born to these couples. In Iceland, the share of births outside marriage is the highest rate in Europe (Jónsson Ari, 2021).

The age pattern of fertility has shifted over time along with the decline in fertility. For most of the 1800s, women ages 30 to 34 years had the highest fertility rates simply because fertility was high overall, and the number of years women were having children was quite extended. In the early 20th century, the peak was women ages 25–29 years as the overall fertility declined. In the second half of the 20th century, the peak was among women ages 20–29 as

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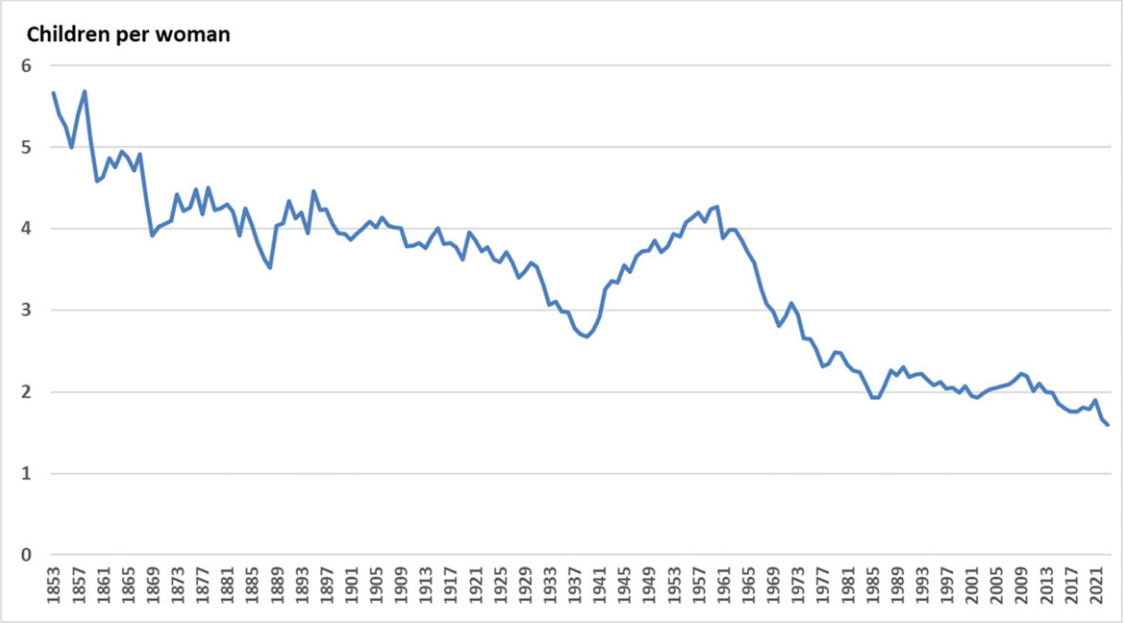

Figure 5. Total fertility rate in Iceland, 1853–2023. Source: (Statistics Iceland, 2024c). The total fertility rate is the number of children a woman could expect to have if she went through her childbearing years at the current age-specific fertility levels.

childbearing was lower and women did not continue to have large families with high levels of childbearing extending into their 30s. In recent years, the peak ages of childbearing have moved older as women ages 25–34 years have the most children. Women postpone childbearing while they pursue education and careers, characteristic of societies at later stages of the demographic transition where fertility is more controlled. This is supported by data on the mean age of all births and first births. From 1961 to 2021, the mean age of first births has risen from 22 to 30 and the mean age of all births from 26 to 31 (Statistics Iceland, 2024c).

The age transition: An aging Icelandic population

The age transition is when a population goes from having many young people and a young median age to having more older people and an older median age. When fertility and mortality are high, there are more young people and people do not live to old ages. As fertility and mortality decline, there are fewer young people, and a larger share of the population live to older ages. The issue of ageing populations, with high shares of persons above retirement ages relative to the number in working ages has become a concern to Iceland and other European countries.

As the population of Iceland has proceeded along the demographic transition, the age structure of the population has developed and aged accordingly. The age–sex structure of Iceland's population is shown at four points in time 1841, 1900, 1960, and 2020 (Fig. 6). In 1841, the mean age of the population was 28.0 years, with a large gap between males and females, 26.6 years and 29.2 years respectively. The pyramid evidenced a more youthful population where younger cohorts were larger than older cohorts. Also, evident were the various kinks and echoes from past periods of high mortality and lower fertility. The excess of females over males is also evident. For the total population, there were 90 males per 100 females. In the older ages, the deficit of males was even greater as male mortality was significantly higher, largely due to high male mortality in fishing. Another factor was the lack of breastfeeding of newborns which had a disproportionate impact on males (Garðarsdóttir, 2002).

By 1900, the population was in a period of rapid growth and the age structure showed this appearing more pyramid-shaped with larger young cohorts. By 1960, the population had increased to 178,000 from 79,000 in 1900. The median age had increased slightly to 29.3 years from 28.1 in 1900 and the male–female life expectancy gap had narrowed. The kinks between cohorts had smoothed as mortality had lessened. There was clear evidence of the post-war baby boom with much larger cohorts at all ages 20 years and younger. By 2020, the mean age of the population had increased considerably to 38.3 years. With the declines in fertility, the younger cohorts were much smaller than older ones and the overall age–sex structure represented that of a much older population.

Urban transition: The population moves from the countryside

The period of Iceland's demographic transition coincided, and was in fact driven, by structural changes in its economy (Fig. 7). In 1801, 86 per cent of the population was employed in agriculture, 6 per cent in fishing, and 5 per cent in services. The percent employed in agriculture would steadily decline to less than half in 1910 and to just 5 per cent in 1990. Manufacturing would increase, peaking at nearly one-quarter of the population before declining to 19 per cent in 1990. Like other western countries, the service sector in Iceland grew considerably over the 20th century (Garðarsdóttir, Bjarnason, Jónsson, & Shuttleworth, 2020). The percent of the population employed in services would grow to more than one-quarter of the population in 1990 and become the largest sector. Employment in trade, restaurants, and hotels would also grow, increasing to 15 per cent in 1990.

Urban is a relative term, but with advances in fishing, the coastal fishing villages began receiving migrants from the countryside in the second half of the 19th century. Urbanisation came late to Iceland because the physical geography of the country had divided

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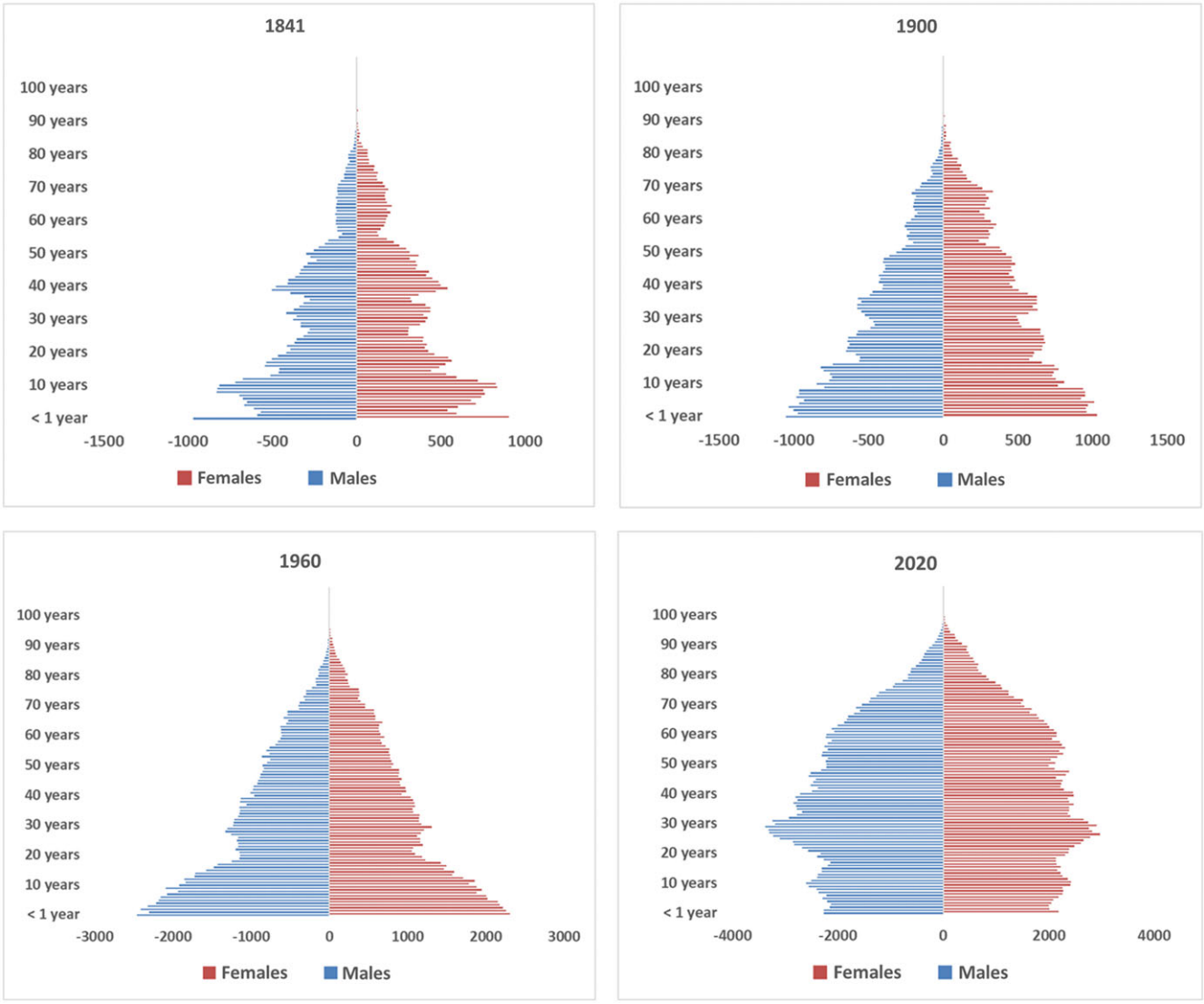

Figure 6. The age–sex composition of Iceland, 1841, 1900, 1960, and 2020. Source: (Statistics Iceland, 2024c).

it into distinct units, and urban settlements were only possible in a narrow collar along the coasts of the country, and that for much of the country's history, people were farmers who produced for themselves or a small group of families and there was not much trading with other small settlements. Commensurate with the growth of the population were changes in its spatial distribution. The territorial administrative structure of Iceland has changed over time. The country is currently divided into 8 regions (Landsaedi) and 70 municipalities (Sveitarfelög). Figure 8 contains maps of the population distribution of the country among the eight regions at four different years over the past two-and-a-half centuries, encompassing the period rapid population growth.

The population size in 1769 was close to a nadir and stood at only 46,271. As noted above, the 18th century was not a favourable one for economic or population growth in Iceland. The region with the largest population was the South with a population of 10,934. The Capital region had a population of only 2,317. By 1901, the population had begun to grow and reached 78,470. Fishing became a major industry and occupation whereas previously, it had been a side activity to farming carried out on a small scale. Settlements with good harbours began to attract people working in fishing full time and to grow. Later, motorised boats and trawlers increased the productivity of fishing contributed to the growth of small urban settlements. The South was still the largest settlement, but the Westfjords, with many good harbours, grew significantly and was the second-largest region. The Capital region grew but still only had 9,507 persons, though this would soon begin to change.

The population more than doubled by 1960 and reached 175,680, a period of exceptional modernisation and population growth (Bjarnason & Thorlindsson, 2006). The emergence of Reykjavik as the centre of population growth is clear as it reached a population of 89,118.

Though Reykjavik was the site of the first settlement in Iceland, it did not develop into the capital and major – some would say only – urban centre in the country until much later, as for most of Iceland's history, the population was spread out among thousands of small farms. At the time of the 1703 census, the population of Reykjavik consisted of 21 persons in the main farm and 48 on outer lying farms (Karlsson, 2000, p. 175). It was a coincidence that the site of the first settlement would later develop into the major urban

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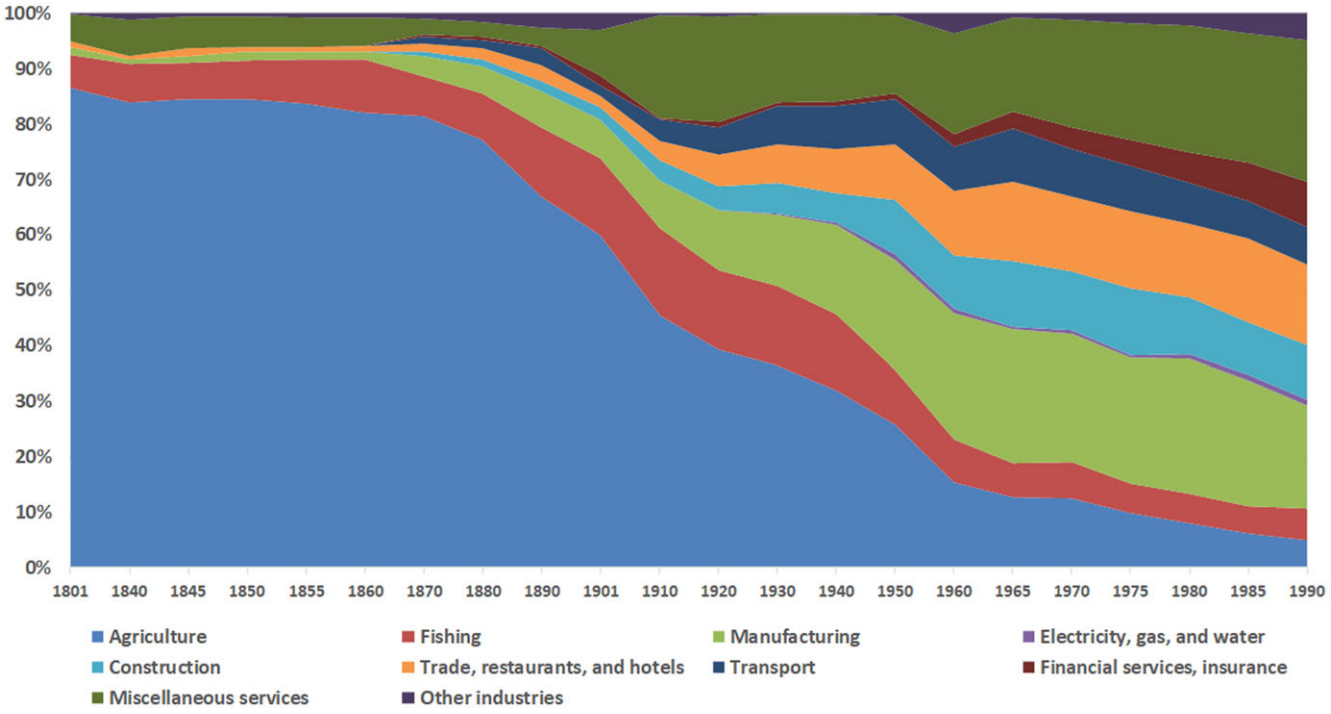

Figure 7. Population by industry, 1801–1990 (percent of total population). Source: (Statistics Iceland, 1997, s. 217).

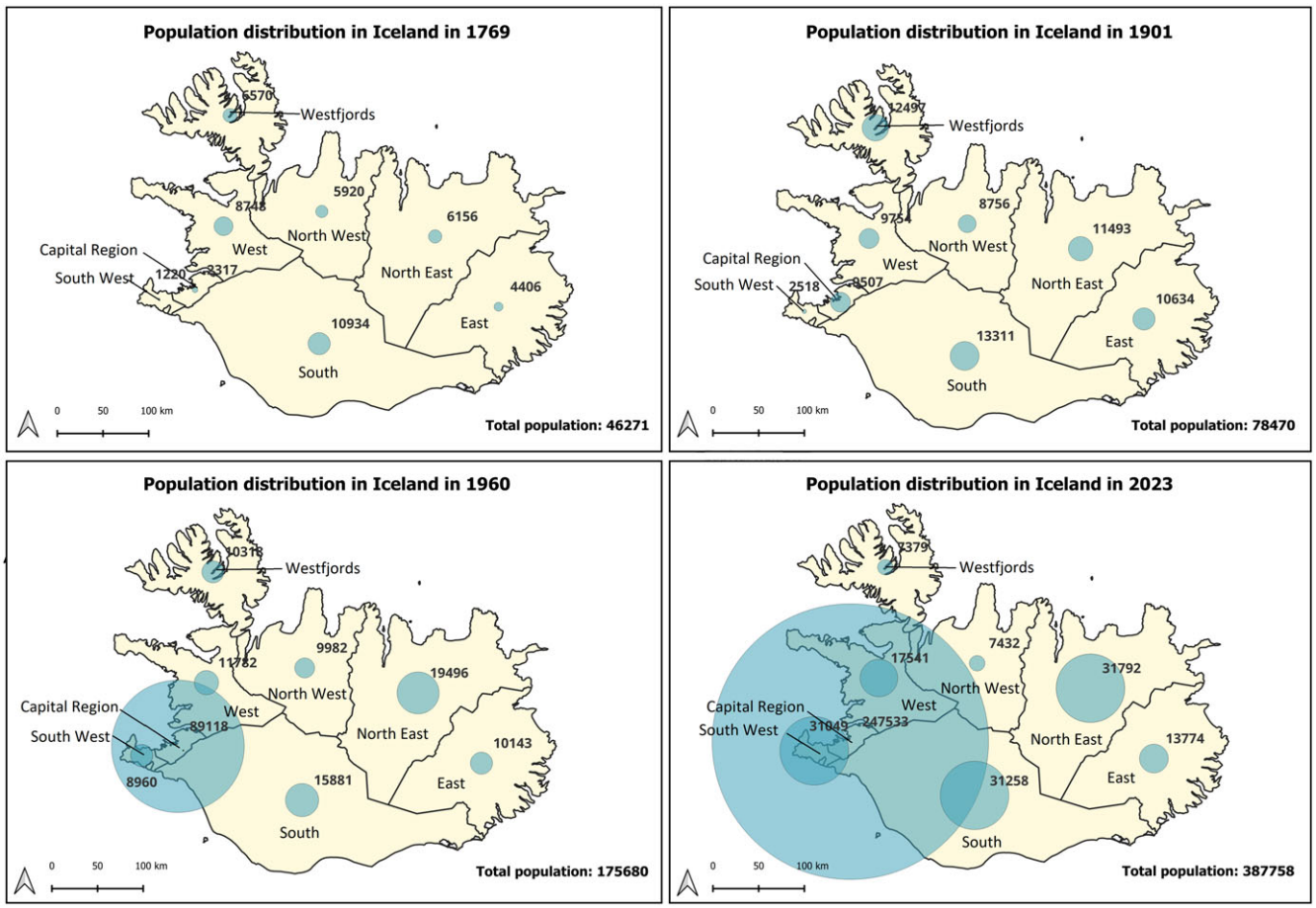

Figure 8. The population distribution of Iceland, 1769, 1901, 1960, and 2023. Source: (Statistics Iceland, 1997; Statistics Iceland, 2024c).

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centre in the country. The process of Reykjavik becoming the major urban settlement in the country began slowly starting in the 19th century with the growth of fishing in schooners and the economic importance of fishing. With more advanced methods of fishing, catches increased in Reykjavik and the surrounding villages in the southwest, further fuelling the region's status as the economic centre of the country. An improved road system also facilitated more stable supply of fresh agricultural produce into the capital.

Later, Reykjavik would accumulate social infrastructure in addition to being the administrative centre of the country. Various schools were established in the late 19th and early 20th century, which would be combined to form the University of Iceland in 1911 (Valsson, 2003, p. 89). The bishop's seat was moved from Skalholt to Reykjavik along with a school. The Althing was also moved to Reykjavik in 1798. Over the period since 1960, most of this growth has been concentrated in the Capital region, which has grown to 247,533, now containing nearly two-thirds of the Iceland's population. Other regions have grown more slowly or in the case of the Westfjords and Northwest, declined in population. With such a concentrated settlement structure, there remains a dilemma in regional policy of whether to maintain a balance of among settlements of all sizes or focus on larger urban areas (Kokorsch & Benediktsson, 2018).

Migration transition: Icelanders abroad

The migration transition is the permanent movement of people from one place to another, usually in response to resource scarcity, in the area of origin relative to perceived resources in the destination area. In Iceland, the migration transition was caused by structural changes in the economy, primarily the modernisation of fisheries and also locating key economic and other resources in Reykjavik, so that it became a magnet for people from elsewhere in the country.

In a small country like Iceland, the migration transition can also include emigration to other countries. Until the 1870s, there was little emigration from Iceland or into Iceland and the population remained quite homogeneous but starting in 1872, there began some emigration to North America with most going to Canada. In 1870, only 300 Icelandic-born persons resided in Denmark (Karlsson, 2000, p. 234). Manitoba was the main concentration of "New Iceland" in Canada. The period from 1872 to 1921 was the period of highest emigration with a net emigration of 16,000 persons (Fig. 1). Another source puts the number of emigrants to America at 14,268 between 1870 and 1914, which represents 20 per cent of the population (Statistics Iceland, 1997, s. 144). Other sources note that the emigration could have been higher, 16,000 to 20,000, which would have been 20 to 25 per cent of the population (The Icelandic Emigration Centre, 2021). There were both push and pull factors behind this flow. The last decades of the 19th century were a period of quite cold weather, and there was another volcanic eruption in the Dyngjufjöll mountains in 1876 (Hjalmarsson, 2007, s. 120). Travel had become easier with the advent of the steamship and both the United States and Canada were actively encouraging immigration. In 1921, there were 6,776 persons born in Iceland who were living in Canada, 15,875 persons of Icelandic origin, and 15,000 persons whose mother tongue was Icelandic. In the United States in 1920, there were 2,369 persons born in Iceland and 5,105 native Icelandic speakers (Statistics Iceland, 1997). Thus, when migration to North America slowed after 1920, there were rather significant Icelandic diaspora populations in both.

It is common for Icelanders to go abroad for a period for study, work, or adventure. About 80 per cent return to Iceland. This return migration rate is much higher than other Nordic countries (Garðarsdóttir, Bjarnason, Jónsson, & Shuttleworth, 2020). The United Nations makes estimates of the migrant stock by country of origin based on sources in destination countries (United Nations Department of Economic and Social Affairs, Population Division, 2020). The number and share of Icelanders living abroad has steadily increased. In 1990, there were 17,597 Icelanders residing abroad which was 7 per cent of the population. In 2020, the size of the Icelandic diaspora had increased to 43,251 which was 12 per cent of the population. The countries with the largest Icelandic diaspora populations were Denmark (8,479), the United States (8,241), Norway (7,786), and Sweden (6,144).

Migration transition: The world discovers Iceland

The number and share of foreign citizens in Iceland have grown significantly with increased immigration (Fig. 9). In 1940, there were barely one thousand foreign citizens in Iceland, just 1.0 per cent of the population. The population was so insular that until the mid-1990s, persons wishing to obtain Icelandic citizenship were required to adopt an Icelandic surname (Jóhannesson, Gunnar Thór, & Björnsson, 2013). The share of foreign citizens would remain quite low, less than 2 per cent of the population, until the mid-1990s. At this time, the Icelandic economy was growing rapidly and there was a need for labour which was increasingly being met by foreign citizens. Two events contributed to the growth in immigration, the economic boom after 2005 and the opening of immigration to new European Economic Area (EEA) states, of which Iceland is a member (Júlíusdóttir, Skaptadóttir, & Karlsdóttir, 2013). The number and share of foreign citizens steadily increased, peaking at 24,379 in 2009, which was 7.6 per cent of the population. Following a banking crisis in 2008, when the country's three largest commercial banks defaulted there was an economic contraction and rise in unemployment. However, through a series of internal and external measures, GDP began to grow again in 2011 (Statistics Iceland, 2024a). As the economy expanded, immigration to the country increased again and the number and share of foreign citizens reached historically high levels in 2024, with the 63,528 foreign citizens making up 16.6 per cent of the population.

In 1998, there were 5,635 foreign citizens in Iceland. In that year, the countries with the largest numbers of foreign citizens residing in Iceland were Denmark (918 persons), Poland (735), and the United States (580). The following year, people with Polish citizenship would overtake those with Danish citizenship as the largest group and they remain the largest. Since 1998, the number of people with Danish citizenship has declined to 880, while those with Polish citizenship has increased substantially to 23,352. These were followed by foreign citizens from Lithuania (2,306) and Germany (1,077). Male immigrants began to outnumber females starting in 2005, because of the demand for male labour in construction in Reykjavik, megaprojects in the east such as a hydropower plant in the highland interior, and an aluminium plant (Júlíusdóttir, Skaptadóttir, & Karlsdóttir, 2013). The hydro-electric power plant and aluminium smelter were huge in an Icelandic context and could not be filled with native labour who seemed to have little interest in such work (Seyfrit, Bjarnason, & Olafsson, 2010). The increased number and spread of foreign citizens are resulting in transformation of gender and ethnic relations in even small resource-based localities which had

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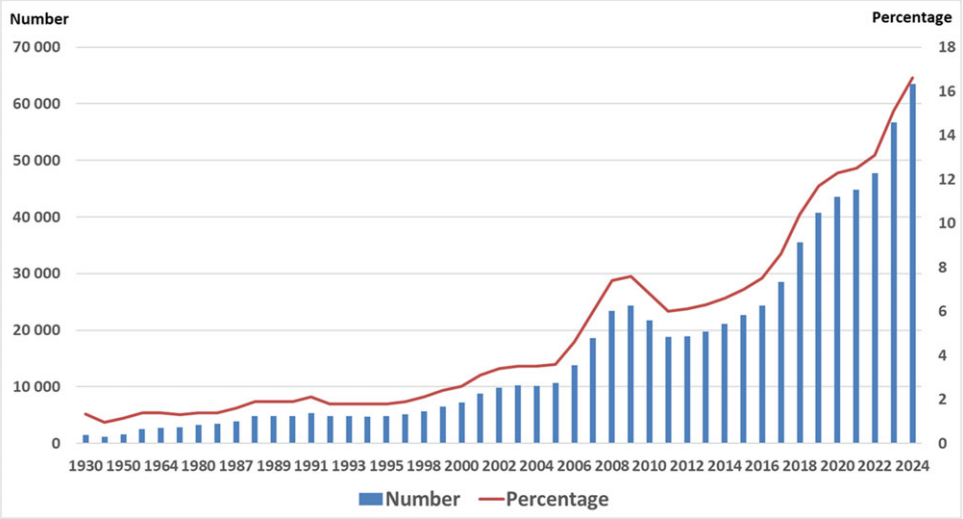

Figure 9. Number and percent of foreign citizens in Iceland, 1930–2024. Source: (Statistics Iceland, 1997) (Statistics Iceland, 2024c).

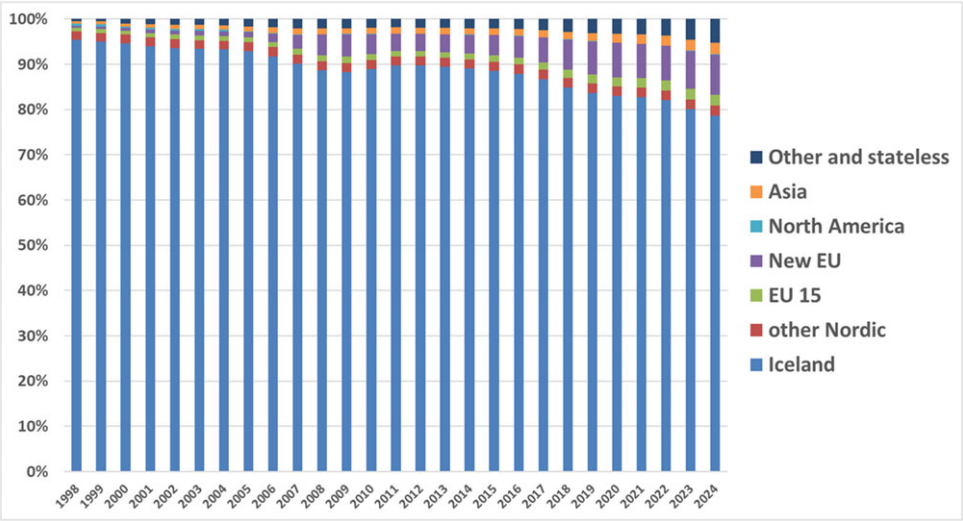

Figure 10. Foreign-born population in Iceland, 1998–2024. Source: (Statistics Iceland, 2024c).

previously seen very few foreigners (Dís Skaptadóttir, 2004). To some extent, the immigration of foreign workers has also compensated for the depopulation of smaller coastal villages.

In 2020, foreign citizens made up 13.5 per cent of the population. There are many smaller municipalities with large shares of foreign citizens, the highest share being in Mýrdalshreppur (27.4 per cent), a small town near Vik on the south coast. Of larger municipalities with over 2,000 persons, the highest shares are in Reykjanesbær, near Keflavik Airport (15.5 percent), Norðurþing, in northern Iceland near Húsavík (13.4 per cent), Grindavík, a fishing town on the peninsula south of Reykjavik (13.0 per cent), Fjarðabyggð in eastern Iceland, the location of the aluminium smelter (12.5 per cent), Sveitarfélagið Hornafjörður, in southeast Iceland (11.5 per cent), and Reykjavík, the capital (10.1 per cent) (Seyfrit, Bjarnason, & Olafsson, 2010). Somewhat surprisingly, Akureyri, Iceland's second-largest city has a rather small share of foreign citizens (3.3 per cent) despite also being the location of a university.

Data on the foreign-born population show an increase in the number, share, and diversity of countries of birth (Fig. 10). Just over two decades ago, in 1998, 95.4 per cent of the population had been born in Iceland and less than 5 per cent were foreign-born. Citizens from the other Nordic countries have always enjoyed privileged status when migrating to or applying for citizenship in Iceland (Jóhannesson, Pétursson, & Björnsson, 2013). In 1998, 97.2 per cent of the population had either been born in Iceland or another Nordic country. If the other EU15 countries were included, less than 2 per cent of the population had been born outside of Iceland, the other Nordic countries, or the EU15 states. Thus, the population was quite homogeneous with little diversity.

Most recently, in 2024, the percent foreign-born had increased to 21.3 per cent of the population and the share native-born had declined to 78.7 per cent. The share of those born in the other Nordic countries had remained the same, about 2 per cent of the population. The largest were those from the new EU member states who gained the right to work in the EU in successive expansions

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starting in 2004. The share of those from the new EU states increased from 0.4 to 8.3 per cent of the population since 1998. The largest group are those born in Poland which increased from 820 in 1998 to 22,431 in 2024. Polish-born people now make up 6.0 per cent of the total Icelandic population.

Conclusion: The current and future demographic situation in Iceland

Iceland's impressive literary and record-keeping tradition allow careful study of its short population history. During the past century and a half, Iceland has made a remarkable transition from a poor, rural society residing mostly in turf houses into a modern, urban, and advanced country. The modernisation of Icelandic society allowed it to become a fully independent state. Indicators such as the infant mortality rate and life expectancy are among the best in the world. The population is nearly five times the size it was in 1900, having increased to 383,726 from 78,000. The population is projected to continue to increase, reaching 443,309 in 2066 (Heleniak, 2020). Most of this growth is projected to be in the Reykjavik capital area, which will increase from 64 to 78 per cent of Iceland's total population as the country continues to urbanise. Despite, or perhaps because of these achievements, Iceland faces several demographic challenges.

Iceland completed the first demographic transition faster than many countries and has entered a second demographic transition. This is characterised by postponement of marriage and childbirth, increases in cohabitation, and increases in personal freedom (van de Kaa, 1987). Other aspects of the second demographic transition are structural sub-replacement fertility. Fertility in Iceland has been at or below replacement level for the past four decades and has declined to even lower levels over the past decade. This has largely been driven by a decline in first births or increased childlessness (Heleniak, 2024). With the trend of increased childlessness, Iceland and the other Nordic countries might be moving towards lower cohort fertility (Hellstrand et al., 2021). The generous support policies towards birth and child rearing have not changed much in recent decades, so demographers speculate that it is other factors such as uncertainty about the future which is causing women and couples to forego having children.

A recent report on Iceland's future identified two demographic drivers with possible impacts, the ageing population and increased pressure to migrate to peaceful countries, such as Iceland (Government of Iceland, Prime Minister's Office, 2019). Fertility in Iceland and the other Nordic countries is well below replacement level, driven largely by a decline in first births. This could portend increased childlessness and smaller cohort fertility (Jónsson, 2023). While the population continues to increase, over the past decade, two-thirds of the increase is from net immigration and only one-third from having more births than deaths (Statistics Iceland, 2024c). The world has discovered Iceland as both a tourist and migration destination and the small country runs the risk of becoming over-touristed (Sæþórsdóttir & Saarinen, 2016). The population is becoming increasingly diverse as the foreign-born increases, with numerous implications for this previously homogeneous country.

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