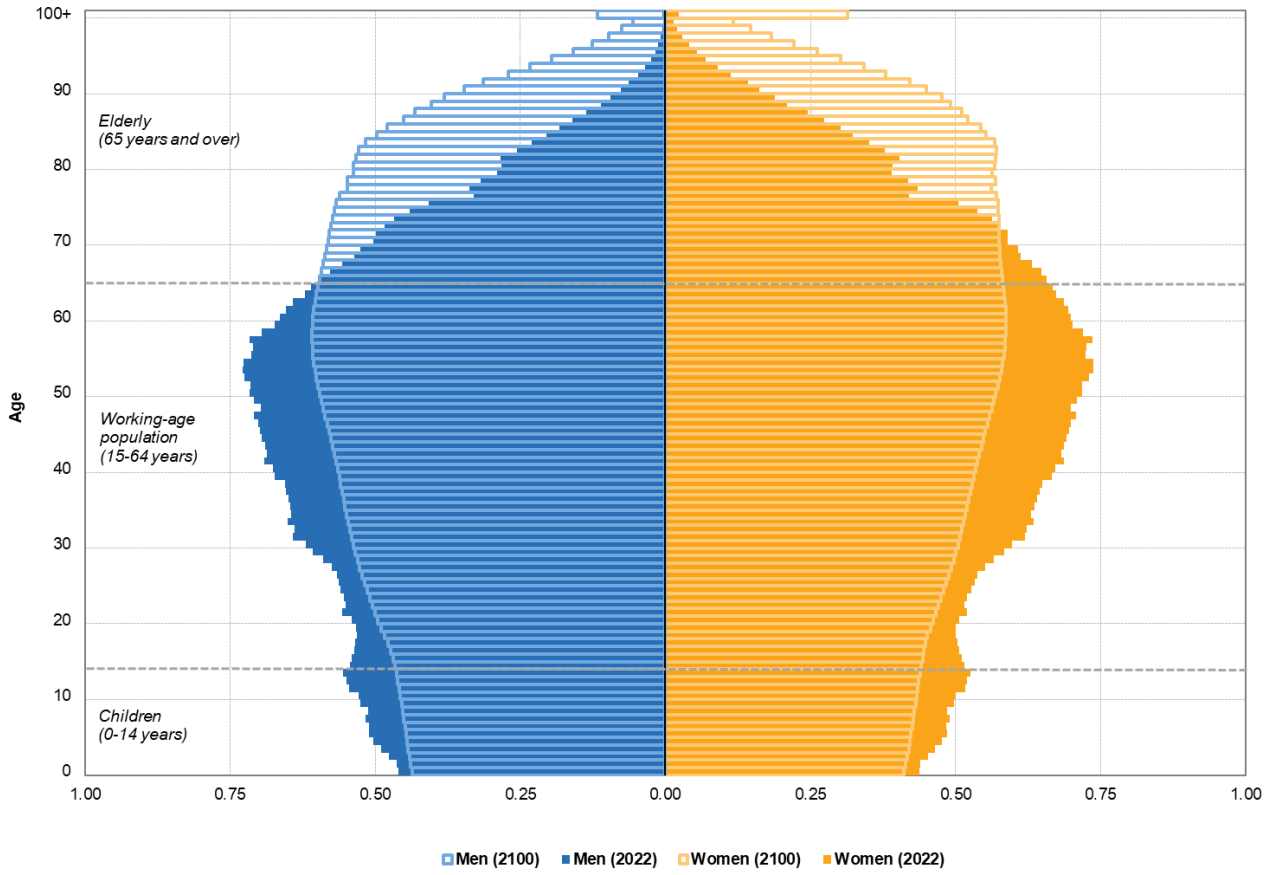
Population projections in the EU - methodology

Statistics Explained

Population pyramids, EU, 2022 and 2100
(% of total population)



Source: Eurostat (online data code: proj_23np)

eurostat

Population pyramids, EU, 2022 and 2100 (% of total population) Source: Eurostat (proj_23np)

Population projections are 'what-if scenarios' that aim to show, for a long-time period, the hypothetical developments of the population size and its structure based on sets of assumptions for fertility, mortality and migration. Eurostat's work on population projections started in 2000 based on a mandate from the Economic and Financial Affairs Council (ECOFIN). Eurostat has published the results of seven rounds of population projections for the EU and EFTA as well as some 'experimental' projections. The most recent are the 2022-based population projections (EUROPOP2023) whose time horizon runs from 2022 to 2100. They provide information about how the population size and structure at national levels would change for EU and EFTA countries if the assumptions on fertility, mortality and migration remained true over the whole projection period. Population projections are used as input for various policies, such as EU cohesion policies or when assessing the long-term sustainability of public finance or analysing the impact of ageing populations on the labour market and potential economic growth.

Population projections published by Eurostat are driven by the assumption of partial convergence of fertility, mortality and migration. They may differ substantially from projections published by other organisations such as the UN , or by projections published nationally due to differences in these assumptions. The purpose of this article is to provide information about Eurostat's methodology and the assumptions used in the estimation of the latest population projections.

Eurostat's mandate and published projections

As the statistical office of the EU, Eurostat was initially called upon to prepare population projections so that the EU could assess and address the impact of the EU population's ageing on public finances in the EU. Later, the interest in and use of population projections grew to cover other topics on the EU agenda. Today's population projections are typically made every 3 years to prepare EU/EFTA, national and regional results. While Eurostat's publication is meant to serve any type of analysis, its timeline remains strongly driven by public finance policy needs within the EU. This section gives details about the requests Eurostat receives for population projections and how the projections have evolved over time.

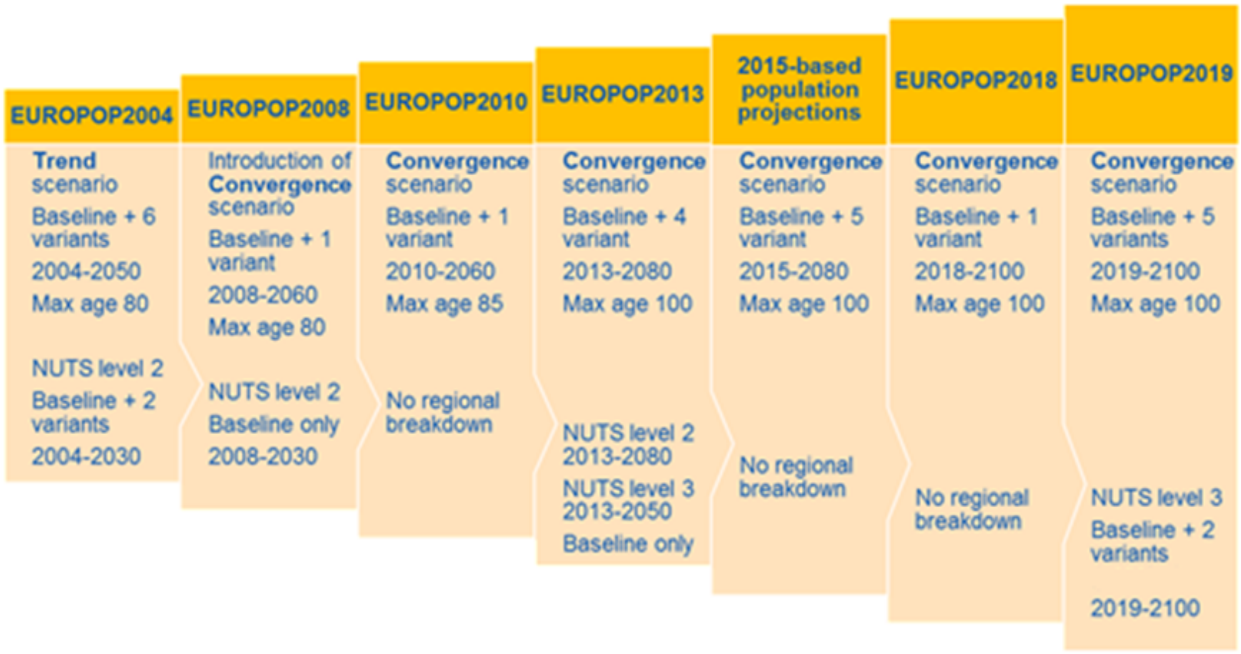


Figure 1: Versions of Eurostat's population projections

In February 2000, the ECOFIN Council asked the Economic Policy Committee (EPC) to prepare a first progress report by December on the impact of ageing populations on public pension systems and asked Eurostat to prepare population projections. Eurostat's demographic scenarios included high, mid and low-variant demographic projections for European countries and ensured the input for the first EPC Ageing Report. This report looked at the long-term sustainability of public finances, examining the different dimensions involved, including the impact of ageing populations. It represented a major contribution to the then EU agenda and strategic goals for the next decade as agreed by the March 2000 Special European Council in Lisbon.

In 2001, Eurostat provided a demographic forecast to support the EPC analysis of budgetary challenges posed by ageing populations.

In 2003, the ECOFIN Council gave the EPC a mandate to produce a new set of long-run budgetary projections for all 25 Member States, covering pensions, health care, long-term care, education, unemployment transfers and, if

possible, contributions to pensions/social security systems. It called upon Eurostat to prepare population projections. The EPC released its 2005 Ageing Report using the first publicly disseminated projections based on the annual demographic figures published in EUROPOP2004.

In 2006, the ECOFIN Council gave the EPC a mandate to update and expand its age-related expenditure projections, based on a new population projection by Eurostat. The EUROPOP2008 demographic projections were released in April 2008. They served as input for the EPC report, presenting the expenditure projections for pensions, health care, long-term care, education and unemployment transfers for all Member States.

EUROPOP2008 developed a 'convergence scenario' based on the population on 1 January 2008. The assumptions were developed with the idea that the socio-economic differences between EU Member States would diminish in the long run. If the narrowing of differences concerned the demographic drivers, then this assumption would imply a convergence of demographic values. EUROPOP2008 included regional population projections at level 2 of the Nomenclature of territorial units for statistics (NUTS level 2). These regional projections presented one of several possible population change scenarios based on assumptions for fertility, mortality and migration for the period 2008-2030.

The EUROPOP2010 projections were released in April 2011, covering the period from 2011 to 2060. The analysis focused on population ageing, a topic the Commission addressed in its Communication on the Green Paper 'Confronting demographic change: a new solidarity between the generations' and in its Communication on 'Dealing with the impact of an ageing population in the EU'. Through its Working Group on Population Projections (WGPP), Eurostat actively involved national statistical institutes (NSIs) in preparing the EUROPOP2010 population projections.

EUROPOP2013 included the main scenario for 2013-2080 and four variants for 2013-2060.

In 2015, the ECOFIN Council asked the Commission to undertake its regular in-depth overall assessment of the sustainability of public finances and asked the Commission and Member States to further analyse new demographic developments, including the effect of large migration flows on macroeconomic conditions and public finances. The Economic Policy Committee was to report back to the Council on the basis of the in-depth overall assessment. The ECOFIN Council also asked the EPC to update its analysis of the economic and budgetary implications of population ageing using new population projections to be prepared by Eurostat in close cooperation with the NSIs. Moreover, ECOFIN asked Eurostat to systematically provide annual updates of their population projections, in particular in light of migration flows, to be used over the short to medium-term forecast horizon. Eurostat published 2015-based population projections, which covered the period from 2015 to 2080 and served as input for the 2015 EPC Ageing Report.

The following publication was EUROPOP2018, which provided projected values for the period from 2018 to 2100. In 2018, the ECOFIN Council gave the EPC a mandate to produce a new set of long-term projections of age-related expenditure by 2021, on the basis of new population projections provided by Eurostat. It also welcomed Eurostat's ongoing work on improving the governance of population projections.

EUROPOP2019 projections for the EU, the euro area , Member States and EFTA countries were published in April 2020. The EPC 2021 Ageing Report used these projections. In January 2021, EUROPOP2019 was complemented with regional population projections at NUTS level 3. These regional population projections were based on population and vital events statistics up to 2018 corresponding to the NUTS 2016 classification, which divides the economic territories of the 31 countries into 1 216 geographical statistical units at NUTS level 3. They covered a time horizon running until the end of the century.

Principles of EUROPOP2023

EUROPOP2023 refers to the national population projections Eurostat published in March 2023 for all the EU and EFTA countries (with the exception of Liechtenstein). The time horizon spans from the year 2022 (also called the base year of the projections) to 2100. The approach used is deterministic projections, or 'what-if' population projections, based on assumptions of a future course of fertility, mortality and migration. Population projections are published by sex and age. The scenario for fertility, mortality and migration developments is one of partial convergence among the countries included in EUROPOP2023. This important assumption is based on the idea of socio-economic convergence in the EU, which in turn will lead to convergence of additional drivers of demographic developments. The methodology applied in EUROPOP2023 builds upon the previous projection exercises, and

their methodological reports are useful complements . Applied to countries with varying data availability and quality, the models must be flexible and, at the same time, robust enough to deal with a diversity of demographic profiles without requiring ad hoc adjustments for individual countries. Having the convergence scenario as reference, four independent models are used for each component: fertility, mortality, immigration and emigration. Unless otherwise stated, each model is applied to all countries in the same way. The output of the models is expressed respectively in age-specific fertility rates; age- and sex-specific mortality rates; age- and sex-specific emigration rates; and age-, sex- and geo-specific immigration levels for each of the years covered by this projection exercise. Population by age and sex is calculated by recursively applying the changes brought by the stated assumptions on fertility, mortality and migration. The projections methodology is developed mainly for the EU Member States, which remain the main focus of the exercise. Results are also produced for EFTA countries, with an adapted migration model.

Input data

The data used in EUPROPOP2023 are mostly official statistics that the NSIs provided to Eurostat. Some are from the latest regular Eurostat demographic data collection, which were sent by the countries in December 2022 and disseminated by Eurostat in early 2023 in the Eurostat public database. These data refer to events that occurred in 2021 and to the population at the end of the period (i.e. on 1 January 2022). These were the latest detailed data available to Eurostat when the projections were made. Some of the data are collected on a voluntary basis, which explains why they are not available in the Eurostat database. Total numbers of live births and deaths as well as migration flows referring to 2022 have also been collected as special input for the projections. However, considering that they are not always entirely based on recorded data and that they are further elaborated before being used, they are described below in the section on assumptions.

Nowcast of 2022 data

The nowcast data are used to incorporate the latest empirical evidence into the computations of assumptions. These data are provided by the National Statistical Institutes (NSIs) in the regular Eurostat data collection carried out each year in November, and they cover at least the first six months of vital events occurred in the same year. The NSIs may also – on a voluntary basis – provide data which cover the entire year, especially when nowcast data are revised later in time, as well as migration data. Whilst they are a valid input helping to better calibrate the assumptions, these values are not necessarily exactly replicated in the final projections computations. In some cases, these primary inputs need to be further adjusted before being used in the models. First, the nowcast data provided by the countries are corrected for their provisional nature. This is done by correcting the estimates with a correction factor derived from the relationship of past nowcast data and final estimates in all cases where the nowcasts are consistently higher or consistently lower than the final estimates. This was necessary in this round only for migration data. Secondly, data covering only a part of the year must be expanded to cover the whole period. Thirdly, the data must be disaggregated by sex. For these reasons, the final nowcast data might differ from the original data provided by the NSIs. The following sections describe in more detail the last three parts of the procedure above.

Nowcast of vital events: births and deaths

In order to take into account the seasonality of births and deaths, the partial nowcast data on vital events transmitted by the countries are expanded to cover the entire calendar year using seasonal ARIMA models derived from monthly data in the Eurostat database. For births, the data point for January of 2021 is excluded in the modelling to avoid an influence of the lower number of births in that month that can be attributed to Covid-19 related lockdowns. For deaths, the years 2020 and 2021 are excluded when defining the model, but included in the basis for the nowcast, such that the current level of deaths but pre-COVID seasonality are used to derive the nowcast for 2022.

Nowcast of migration flows: immigration and emigration

The nowcast of migration flows for 2022 is computed by extrapolating the average of the available data of 2022 to cover the entire year. If a country has not provided any preliminary migration data, the flow is estimated to have a size equal to the previous year. For immigration, refugees under temporary protection have been subtracted from the nowcast if they were included, as they are added in a separate step in the projections. Past nowcast data has been compared to past final migration data. In cases where the difference exceeded 10 %, a correction factor was

EU/EFTA Member State	break in any input data due to the 2021 population and housing census[1]	Country specific notes
Belgium	no	
Bulgaria	no	
Czechia	yes (2022)	
Denmark	no	
Germany	no	Age groups 95+ for immigration and emigration are not reported, but derived by distributing the reported number for age group 95+ (inverse exponentially) over the age groups 95 to 100+
Estonia	no	
Ireland	no	Age and sex breakdowns for refugees under temporary protection are not available, and were derived using the distributions from Belgium
Greece	no	Small inconsistencies in some age groups for immigration in 2019 and 2020. Unflagged break in time series in 2022 due to 2021 population and housing census.
Spain	no	Non-EU immigration from South America has not been modelled specifically for Spain, even though it exceeds inflows from Ukraine.
France	no	Data on refugees under temporary protection for persons aged 18 or less was not transmitted to Eurostat. For the purpose of the projections, it is estimated based on the number of persons 18 or older, as well as the relation between the two age groups derived for the EU.
Croatia	yes (2022)	Net migration was set to zero for the mid-term by adjusting the level of emigration.
Italy	yes (2019)	
Cyprus	no	
Latvia	no	Small inconsistencies in some age groups for immigration in 2018
Lithuania	no	
Luxembourg	no	
Hungary	no	Age breakdowns for refugees under temporary protection were reported without age breakdown. The structure derived from Austria was used to break down the total figures.
Malta	no	Population density for Malta has not been taken into account as a limiting factor for the projected population size.
Netherlands	no	Large number of refugees under temporary protection were reported without sex. They were distributed according to the structure observed in the reported data.
Austria	no	
Poland	no	
Portugal	yes (2022)	Due to revised data transmitted to Eurostat for the purpose of population projections only, and their impact on population and mortality rates, life expectancy data projected from 2022 onwards cannot be compared with published data from 2021 and before; migration data totals included in the projections are also revised due to the Census 2021, and not yet published in the database at the time of data release.
Romania	no	
Slovenia	no	
Slovakia	no	
Finland	no	Age-specific mortality rates for 2022 have been transmitted by Finland and are used in the projections instead of the assumptions formulated by Eurostat. Finland reported a drop in life expectancy at birth in 2022, after stable life expectancy since 2019. This development is not captured by Eurostat assumptions.
Sweden	no	
Iceland	no	
Liechtenstein	no	Input data was not transmitted in time for production of population projections.
Norway	no	
Switzerland	no	

derived from the years 2000 and 2021 and applied to the reported nowcast data. Reasons for the necessity for such a correction are usually differences in the definition of the data reported as nowcast and that reported for final data. Potential seasonality in migration flows cannot be taken into account as no monthly data on migration is available. If a country has not provided any preliminary migration data, the flow is estimated to have a size equal to the previous year.

Nowcast of refugees from Ukraine under temporary protection

There was no need to nowcast the number of refugees from Ukraine under temporary protection. Data on beneficiaries on 31 December 2022 was available at the time of computation.

Assumptions

Assumptions for fertility The total fertility rate (TFR) is a major determinant of population growth. It refers to the average number of children women would bear during their reproductive years if they had the same probability of having a child at each age as is currently observed. The replacement rate in the EU, which has low child mortality, is estimated at 2.1. At that rate, a generation replaces itself, at lower rates a population must necessarily shrink in the long run. In the EU, no current Member State has exceeded the rate of 2.1 since Cyprus in 1994. In 2020, the total fertility rate in the EU stood at 1.50.

The model applied for fertility has almost no changes as compared to the previous exercise; the only small change refers to the years used to derive the age pattern of fertility and fertility trends, which excludes data for 2021 due to the unknown impact of Covid-19 on fertility trend deviations in general and on individual age groups specifically. To incorporate the nowcast, firstly the age distributions are derived for each country from observed data on births (by age reached) and population. In order to reduce the randomness in the age patterns (more visible in countries with fewer events), data referring to three years (2018-2020) have been pooled before computing age specific fertility rates.

These age-specific fertility rates (ASFRs) are smoothed using weighted regression B-splines. For countries that report zero births for a specific age, the lowest reported rate from any country for that age group was inserted before smoothing. These smoothed patterns are then proportionally inflated or deflated to match the births nowcast figure of 2022 when applied to the base population.

In the second step, assumptions are formulated for the future values of the total fertility rate (TFR). The model combines a country-specific trend extrapolation and the convergence assumption. At the beginning of the projections period (up to and including 2024), the trend extrapolation has full weight. Afterwards, the convergence assumption starts operating, with linearly increasing weight towards the end of the projections period. Country-specific trend extrapolations are obtained from a constrained ARIMA(1,0,1) regression applied to the time series of each country.

The convergence is modelled by assuming a tendency of fertility in all countries towards an ultimate value never reached during the horizon of the projections, and in the EUROPOP2023 round equal to 1.77. This value has been derived using the freeze rate method of projecting TFR of the EU member frontrunners in fertility development, defined as the cluster A countries[2][3], or the upper branch of the fertility fork[4]. These are: Ireland, Sweden, France, Denmark, Finland, Belgium and the Netherlands. The year 2021 is excluded as base for projections due to the impact of Covid-19; based on data from 2016 to 2020, the rate of 1.77 is derived. The ASFRs for the convergence value are based on a Schmertmann model with R = 0.122, α= 14, P = 32.50 and H = 38.50. For justification in using

[2]Lesthaeghe, Ron. "The Second Demographic Transition, 1986–2020: Sub-Replacement Fertility and Rising Cohabitation—a Global Update." Genus 76, no. 1 (June 9, 2020): 10. https://doi.org/10.1186/s41118-020-00077-4 .

[3]Lesthaeghe, Ron, and Iñaki Permanyer. "European Sub-Replacement Fertility: Trapped or Recovering." Population Studies Center Research Report, no. 14–822 (2014).

[4]Rindfuss, Ronald R., Minja Kim Choe, and Sarah R. Brauner-Otto. "The Emergence of Two Distinct Fertility Regimes in Economically Advanced Countries." Population Research and Policy Review 35, no. 3 (June 1, 2016): 287–304. https://doi.org/10.1007/s11113-016-9387-z .

the freeze rate method, please see (Bohk-Ewald et al., 2018)[5]and (Hilton et al., 2019)[6]. A recent publication discusses the development in the Nordic countries, and comes to the conclusion that "the long-standing pattern of stable cohort fertility close to replacement level across the Nordic countries is no longer warranted"[7]. This paper also discusses evidence casting doubt on the role of gender equality or family-friendly policies for high fertility. The main reason for the decline in fertility seen in the second decade of this century seems to be voluntary childlessness as indicated by a quantum decline, and not further postponement.

The intermediate age-specific fertility rates between 2022 and the rates in the convergence year are obtained by linear interpolation. These interpolated rates are then proportionally inflated or deflated such that their sum matches the projected TFR in the corresponding year.

Assumptions for mortality Mortality patterns since 2020 have been massively impacted by an increase in mortality rates due to the COVID-19 epidemic. The impact has led to drops or stagnation of life expectancy in all European countries, though the timing and extent of this impact was not uniform across all countries[8]. Overall, persons in the EU had a life expectancy at birth of 80.1 in 2021, down from 80.4 in 2020 and 81.3 in 2019. The assumptions formulated for mortality are based on the idea that in 2022 and 2023 the mortality rates have not completely aligned with levels observed before the epidemic, but that they will fully return to that level by 2024. This means that for 2022, age- and sex-specific mortality rates are derived from the averages of the years 2018 to 2021, while those of 2024 are based on age- and sex-specific mortality rates from 2018 and 2019. 2023 rates are derived as their average. The age-specific mortality rates are smoothed using weighted regression B-splines, constrained to allow equal or increasing rates only after the age of 25. For countries that report zero deaths for a specific age, the lowest reported rate from any country for that age group was inserted before smoothing. From 2024 on, these age- and sex-specific mortality rates are assumed to partially converge towards a common (sex-specific) life table (the 'ultimate' life table), which incorporates some information from previous mortality trends of selected countries. The ultimate life table used in EUROPOP2019[9]is re-used for that purpose, as there is no assumption of a lasting impact of the COVID-19 epidemic on life expectancy. This interpolation returns a higher pace of mortality decrease at the beginning of the period and a slower pace in the long term, coherent with the assumption of a decreasing speed of mortality improvements.

A number of countries have reported higher life expectancy in 2021 than in 2018 or 2019. For these countries, the life expectancy was fixed at the highest observed level until 2024.

Assumptions for migration Migration is the most volatile component in population projections for which assumptions need to be formulated. Levels of immigration and emigration are generally determined by a number of push and pull factors, which are not explicitly modelled in population projections. In the last decades, such factors were the debt and financial crisis, the wars in Afghanistan and Syria, and the impact of measures taken due to the COVID-19 epidemic. In the last year, the inflow of refugees from Ukraine fleeing Russian aggression had large influences on migration flows in the EU. In the future, climate change is expected to be a driver of global migration

[5]Bohk-Ewald, Christina, Peng Li, and Mikko Myrskylä. "Forecast Accuracy Hardly Improves with Method Complexity When Completing Cohort Fertility." Proceedings of the National Academy of Sciences of the United States of America 115, no. 37 (September 11, 2018): 9187–92. https://doi.org/10.1073/pnas.1722364115

[6]Hilton, Jason, Erengul Dodd, Jonathan J. Forster, Peter W. F. Smith, and Jakub Bijak. "Comparing Fertility Forecasting Methods: How Do Parametric Mixture Models Perform?," 2019.

[7]Hellstrand, Julia, Jessica Nisén, Vitor Miranda, Peter Fallesen, Lars Dommermuth, and Mikko Myrskylä. "Not Just Later, but Fewer: Novel Trends in Cohort Fertility in the Nordic Countries." Max Planck Institute for Demographic Research, Rostock, Germany, 2020. https://doi.org/10.4054/MPIDR-WP-2020-007 .

[8]Schöley, J., Aburto, J.M., Kashnitsky, I. et al. Life expectancy changes since COVID-19. Nat Hum Behav 6, 1649–1659 (2022). https://doi.org/10.1038/s41562-022-01450-3

[9]Lanzieri, Giampaolo. (2009). EUROPOP2008: a set of population projections for the European Union. Poster presentation at XXVI IUSSP International Population Conference

patterns. In the next 30 years alone, rising sea levels, drought, increasing temperatures and other climate catastrophes are expected to force globally around 143 million persons to flee their homes, and possibly contribute to continuing high immigration levels into the EU[10]. Trends derived from past data are used to capture the overall development of migration flows. In the current set of population projections, the expected in- and outflows of refugees from Ukraine which currently benefit from temporary protection are in addition modelled explicitly. The modelling choices made with regard to the size and duration of expected in- and outflows of this group should not be understood as a statement with regard to expectations about the severity and duration of the Russian aggression on Ukraine.

Immigration

Total immigration is derived in the current projections from three components: immigration derived from trends of past immigration data, which is assumed to converge towards a level representative of each country's share of the EU population; a working-age feedback mechanism where shrinkages in the working age population are assumed to trigger additional immigration; and for 2022 and 2023, inflows of refugees from Ukraine under temporary protection. The first, and largest component of immigration is modelled separately for immigration from non-EU countries and immigration from EU countries. The model is split into two periods, one for the years 2023 to 2027, and one from 2028 to 2100. For the years 2023 to 2027, the values are derived from a linear interpolation between the nowcast level of 2022, and the average of past immigration levels which is used to estimate expected immigration levels in 2027. This is done to avoid giving a too high weight to the immigration levels nowcasted for 2022. For countries that joined the EU before 2004, this average is derived in principle from the average of the past 20 years, mirroring the data period used to build assumptions in the EUROPOP2019 round. For the countries that joined the EU in or after 2004, this period is set to the past 10 years (2013 to 2022). The reason for this choice is that migration is to a degree driven by intra-EU migration, and many Member States who joined the EU in 2004 and after experienced initially large negative net migration directly after accession that no longer reflect current trends, particularly following Brexit. In addition, not all countries have full back-series available from 2003 on, and fully harmonised data for all countries is only available from 2007 on. The immigration data with full breakdowns by sex and single years of age is only available for total immigration, and only for the years 2013 to 2021. Immigration data that differentiates by broad region of previous residence is only available by 5-year age groups for the same time-period. To derive the age and sex profiles by broad region of previous residence (EU/non-EU) for all countries, iterative proportional fitting (IPF) is used to disaggregate the 2013-2021 averages of this data from 5-year age groups to single ages. The resulting profiles are used to disaggregate the levels of immigration by single age, sex and previous residence for all years 2022 to 2027. From 2027 on, immigration levels are derived from linear interpolation between the mid-term level, and the level of immigration that is derived from the population share each country has in the EU total. The share of men and women for the convergence immigration level is assumed to be equal in the convergence levels, and the age profile by sex and broad region of previous residence is derived from the EU totals of 2013 to 2021. The normalised age profiles by sex and country of previous residence are also derived by interpolation between the profiles in 2027 and the convergence profiles. The level of immigration derived from the linear interpolation (by sex and country of previous residence) is broken down by these normalised profiles to derive the levels of immigration for each single year of age and sex, by region of previous residence.

Working-age feedback mechanism

For each year in the time horizon of projections, the difference in the working-age population (in this case referring to the population aged 15-64 years old) between the beginning and end of the year is assumed to trigger an additional non-EU immigration flow in the same year. This additional immigration is not meant to be a precise 'replacement migration', thus bounded to (young) working ages, but rather a broader pull factor which materialises in immigration at all ages (the 'additional' immigrants can indeed bring their families as well). The additional immigration is assumed to be equal to 10 % of the shrinkage in the working-age population measured in the calendar year. This overall value is then broken down by sex and age in accordance with the profiles adopted for that year (as described in the previous paragraph).

Inflow of refugees from Ukraine under Temporary Protection

Following the Russian invasion of Ukraine on 24 February 2022, large inflows of refugees from Ukraine have been

[10] IPCC, 2022: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.

registered in the EU. For the first time, the Directive on Temporary Protection (TP) was activated on 4 March 2022[11]. Among the rights of beneficiaries of temporary protection are listed:

- a residence permit for the entire duration of the protection (which can last from one year to three years)
- move to another EU country, before the issuance of a residence permit

Based on the duration of the issued residence permit, Eurostat published the following guidance note , which gives clear indication that refugees from Ukraine under TP are to be included in the base population for the purpose of population projections. Given that data on inflows, and particularly on outflows, is inconsistent with the reported stocks, for 2022, the total stocks of beneficiaries of temporary protection at the end of December 2022 has been used to measure the total inflow of refugees in 2022. For 2023, the total inflow of refugees under temporary protection is projected to be 15 % of the inflows observed in 2022. There are no further inflows estimated for the years after 2023, and for this round of projections, no estimates for further inflows due to family reunions have been made. Age and sex profiles of these refugees are derived from the reported data. Available breakdowns are age groups 0-13, 14-17, 18-34, 35-64, and 65 or older, by sex. To derive single year age groups, each age group is disaggregated using the single year age distribution observed in the population of Ukraine in 2021. The derived age and sex profiles are also used to disaggregate the total level of refugees under TP derived for 2023.

Emigration

Total emigration is derived in the current projections from two components: emigration derived from trends of past emigration data, which is assumed to converge towards a common EU emigration hazard rate; and for 2024 to 2033, outflows of refugees from Ukraine who arrived under temporary protection in the EU in 2022 and 2023. The first component of emigration is modelled separately for two periods, one for the years 2023 to 2027, and one from 2028 to 2100, mirroring the modelling of immigration. For the years 2023 to 2027, the values are derived from a linear interpolation between the nowcast level of 2022, and the average of past emigration levels which is used to estimate expected emigration levels in 2027. This is done to avoid giving a too high weight to the emigration levels nowcasted for 2022. For countries that joined the EU before 2004, this average is in principle derived from the average of the past 20 years (2003 to 2022), mirroring the data period used to build assumptions in the EUROPOP2019 round (2000 to 2019). For the countries that joined the EU in or after 2004, this period is set to the past 10 years (2013 to 2022). Emigration data with full breakdowns by sex and single years of age is available for the years 2013 to 2021. The averages of these profiles are used to disaggregate the levels of emigration by single age and sex for all years 2022 to 2027. In 2027, emigration levels, by sex, are converted into hazard rates of emigration; between 2027 and 2100, these hazard rates are assumed to linearly converge towards the average EU hazard rates, and towards equal rates for men and women. The convergence age profile by sex is derived from the EU totals of 2013 to 2021. The normalised age profiles by sex are also derived by interpolation between the profiles in 2027 and the convergence profiles. The level of emigration derived from the interpolation of hazard rates is broken down by these normalised profiles to derive the levels of emigration for each single year of age and sex.

Outflow of Refugees from Ukraine under Temporary Protection

In September 2022, the UNHCR published the result of a survey among refugees in covering 43 countries across Europe and beyond between August and September 2022, with over 4 800 surveys completed. At that point in time, 81 % of respondents indicated the wish to return to Ukraine eventually[12]. A survey conducted in Germany between August and October 2022 indicated that 37 % of refugees from Ukraine would like to stay permanently, and another 34 % indicated their intention to stay at least until the end of the war. Some 27 % were undecided on their intentions to return. Only 2 % planned to leave within a year[13].

In Finland, a survey conducted in June and July 2022 showed that 27 % of refugees from Ukraine living in Finland

[11] https://home-affairs.ec.europa.eu/policies/migration-and-asylum/common-european-asylum-system/temporary-protection_en

[12] UNHCR Regional Bureau for Europe, Data, Identity Management and Analysis Unit (DIMA). "LIVES ON HOLD: INTENTIONS AND PERSPECTIVES OF REFUGEES FROM UKRAINE." Regional Intentions Report. UNHCR, September 2022.

[13] Brücker, Herbert, Andreas Ette, Markus M. Grabka, Yuliya Kosyakova, Wenke Niehues, Nina Rother, C. Katharina Spieß, Sabine Zinn, Martin Bujard, Adriana Cardozo, Jean Philippe Décieux, Amrei Maddox, Nadja Milewski, Robert Naderi, Lenore Sauer, Sophia Schmitz, Silvia Schwanhäuser, Manuel Siegert & Kerstin Tanis (2022): Geflüchtete aus der Ukraine in Deutschland. Flucht, Ankunft und Leben. (IAB-Forschungsbericht 24/2022), Nürnberg, 26 S

at that time stated that they would not return to Ukraine in any event, and 33 % stated that they would return once the war has ended. Around 39 % were uncertain.

Overall, the evidence collected in these surveys indicates that a relevant share of refugees from Ukraine intends to stay in their current host country. For the purposes of the EUROPOP2023 projections, the assumption is that 33 % of refugees will remain permanently in the host country, while 67 % will return. The return period is modelled over 10 years, such that the number of returns per year decreases linearly, until one third of the initial sum of inflows from 2022 and 2023 remain. Please note that this return period is not meant to imply any statement whatsoever on the duration or intensity of the ongoing war. For the returns in 2024, persons arriving in 2022 have been aged by 2 years, while one-year-olds and newborns that have been born to the refugee population have been estimated using the 2021 Ukrainian crude birth rate. The same process (ageing of original refugee population and estimate of newborns) has been applied to all further years. No specific estimates for mortality have been made other than assuming that all persons 100+ die at the end of each year.

Projected population: estimation steps

The final projected population is estimated using the assumptions described above in the following way: The starting point is the population on 1 January 2022 broken down by sex and single year age. The mortality rates are used to derive the number of deaths by sex and age. The number of non-EU and EU immigrants by age and sex are computed. For 2022 and 2023, the number of refugees under TP by age and sex are added. The number of emigrants by age and sex is computed and subtracted from the population (this includes refugees under TP for the years 2024 to 3033). The population at the end of the year by age and sex is computed, and the size of the population in working ages at the beginning and end of the year is estimated and the immigration due to shrinkage is derived. Based on that figure, the number of additional immigrants from non-EU countries by sex and age is computed, and the population at the end of the year by sex and age is re-calculated. Now, the average population in the year by sex and age is derived; on the basis of that, the number of live births by age of the mother and broken down by sex are computed. In the year 2022, total number of live births, total number of deaths, immigration and emigration are calibrated using the nowcast figures.

Alternative scenarios

The population projections produced by Eurostat are deterministic projections, and a specific set of assumptions for fertility, mortality and migration fully determines the projected population. In addition to the baseline assumptions, Eurostat also formulates five alternative scenarios to give insights into the impact change in the assumptions have on the projected population. For the EUROPOP2023 round, these scenarios are lower fertility, lower mortality, as well as zero net migration, lower non-EU immigration and higher non-EU immigration. Specifically, for the scenario on lower fertility, the assumption is that the total fertility rate is 20% lower than that of the baseline in each year covering the projection horizon (2023 - 2100). This means that each year, the number of live births is lower than in the baseline scenario. The scenario on lower mortality is implemented such that in 2100, the life expectancy at birth is two years higher than in the baseline scenario. The scenarios on migration cover zero net migration, as well as 33% less immigration from non-EU countries in each individual year and 33% more immigration from non-EU countries in each year covering the projection horizon. The impact of the different scenarios in each country depends on the individual demographic situation; countries that experience periods of negative net migration will for example show increases in the projected population for some periods in the zero net migration scenario, while those with positive net migration will show decreases in the projected population for that scenario.

See also

- Population projections in the EU

Database

- Population projections (proj)

Dedicated section

- Population projections EUROPOP2023

External links

- United Nations World Population Prospects 2022 Methodology
- US Census Bureau IDB Population Projections Methodology

Notes