Variant national population projections for the UK and subnational population projections and household projections for England: user guide

The aims of this user guide are to provide guidance and examples for those wishing to understand and use variant projections in policy and planning.

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1 . Overview of this user guide

Population and household projections from the Office for National Statistics (ONS) generally consist of a principal projection and a number of variant projections. This guidance is for those wishing to understand and use variant projections in policy and planning, a need for which we are aware of from user feedback and in the recommendations of the Office for Statistics Regulation's review of population estimates and projections. It covers the national population projections, the subnational population projections and the household projections specifically focusing on:

- what variants are, including their purpose, the range of variants available and how they are used in policy and planning

- case study examples from the Office for Budget Responsibility (OBR) where variants are used to inform national-level planning

- three local area case study examples of variant subnational and household projections in use for assessing future housing needs

We are generally using our 2018-based projections as examples because at the time of writing they remain our most recent projections. For more information, read the latest updates on population and household projections.

2 . Definition of variants and purpose

Principal projections

These are based on a set of long-term assumptions considered to best reflect recent patterns of future fertility, mortality and net migration. For household projections we also develop assumptions on future household formation. We derive our assumptions through extrapolation of past trends and by consideration of expert views.

We produce principal population projections to understand possible changes in the future structure of the population. They are based on assumptions considered to best reflect demographic patterns at the time they are adopted and simply show what might happen if recent trends were to continue. However, because of the inherent uncertainty of demographic behaviour, any projection will inevitably differ to a greater or lesser extent from actual future population change. Assumptions are not predictions of the future, but are plausible scenarios based on what has happened in the past.

The assumptions for fertility, mortality and migration, including variant assumptions are agreed in consultation with the National Population Projections Committee comprising the Office for National Statistics (ONS), National Records of Scotland (NRS), Northern Ireland Statistics and Research Agency (NISRA) and the Welsh Government.

Variant projections

We describe variant population projections as alternative projection scenarios when compared with the principal projection. The variant projections we produce are based on alternative assumptions of future fertility, mortality and migration, for the UK and its constituent countries. We produce the variants to give users an indication of the inherent uncertainty of demographic behaviour and show what the potential outcomes could be from different assumptions of future demographic change.

In our projection releases we normally offer a set of variant projections based on alternative scenarios according to higher or lower assumptions about the trajectories of fertility, mortality and migration. We generally determine our set of variant projections through user engagement. Overall, the variant projections provide an indication of sensitivity to alternative assumptions, but they should not be interpreted as upper or lower limits of future demographic behaviour.

Variant projections, and the demographic scenarios they represent, are especially useful for planning purposes because it is impossible to project future population levels with complete accuracy. As the principal projections are based on recent trends in births, deaths and migration, they may not be accurate projections of future trends, in particular, the projections take no account of future policy changes. They simply show what might happen if recent trends were to continue. The variant projections enable users to explore a range of possibilities and the effects of changing the underlying assumptions on population and household projections at national and local levels.

The purpose of population projections

National population projections (NPPs) are used within and outside of government as the definitive set of national population projections. Examples of their uses include forming fiscal projections, identifying future demand for health and education services and estimating the future cost of State Pensions. We determined from user feedback that the NPPs can offer an early indicator of latest trends and they are also used as the base for subnational population projections and household projections. The subnational population projections (SNPPs) are important for a number of services including planning local housing and education, electoral, neighbourhood resource allocation and health and social services.

3 . How we produce variants

National population projections

The national population projections (NPPs) are produced from one mid-year to the next using a standard demographic method. The variants are produced using broadly the same approach as for the principal projection; production of the variants differs from the principal projection by the use of different assumptions of future fertility, mortality or migration. For example, the single-component variants are produced by showing the effect of varying one assumption while keeping other assumptions in line with the principal projection; others are combination variants, which are produced by varying two or more assumptions.

In the 2018-based NPPs the EU variant assumptions were produced by applying percentage changes by single year of age and sex to the principal international migration assumption. Further information is available in National population projections, variant projections: 2018-based.

Subnational population projections and household population projections

The subnational population projections (SNPPs) are produced from one mid-year to the next using a standard demographic method. The variants are produced using broadly the same approach as for the principal projection, with a few differences.

These differences are largely in the constraining of the variant component totals to match the variant being produced. For example, when producing the high international migration variant, the migration component totals are constrained to match those in the high international migration variant NPP for England. In addition to the component, the resulting sum of SNPPs are constrained to the equivalent variant projection for England. A similar process is applied to the low international migration variant. The alternative internal migration variant and the 10-year migration variant are constrained to the principal NPP for England.

4 . Range of national population projections variants

The range of variant national population projections (NPPs) we normally publish alongside the principal projection, with the assumptions underlying each variant, are illustrated in Table 1 (2018-based NPP release).

Some of these are single-component variants, which show the effect of varying one assumption while keeping other assumptions in line with the principal projection. Others are combination variants, which look at the effect of varying two or more assumptions. A few variants such as "replacement fertility", "constant fertility" and "no mortality improvement", use "special case" assumptions, which enable a particular set of scenarios to be represented. Further information on how these assumptions are defined are available in National population projections, variant projections: 2018-based.

In the 2018-based NPPs our methods included demographic assumptions on future levels of fertility, mortality and migration. These assumptions are not predictions of the future, but are plausible scenarios based on what has happened in the past. Most of the variants use the principal, high and low long-term assumptions for fertility, mortality and migration. For an example, the 2018-based assumptions at the UK level are summarised in Table 2.

For how we developed the fertility, migration and mortality assumptions for the 2018-based NPPs and what the long-term assumptions are for each country see the National population projections, how the assumptions are set: 2018-based methodology.

Figure 1 provides the range of demographic scenarios we published for the 2018-based projections to illustrate what our estimated and projected population looks like. Table 3 provides users with the projected population increases at UK level provided by variant scenarios that show different population changes compared with the principal projection. This is helpful for users in their consideration of the long-term outcomes of different assumptions.

5 . National population projections – Office for Budget Responsibility case studies

Context

The Office for Budget Responsibility (OBR) used population growth figures provided by the national population projections (NPPs) variant population projections to construct population forecasts and age profiles in a few different areas.

Variants

Natural change and zero net EU migration variants were used in economic and fiscal forecasts instead of the principal projection because of a significant change in immigration policy announced in March 2020. The zero net EU migration variant and age-related variants were used in the Fiscal Sustainability Reports (FSRs) to help users understand the sensitivities of the public finances to possible future demographic change.

Example uses

- The OBR's central economic and fiscal forecast published after the first part of the pandemic in November 2020 used the natural change and zero net EU variants to construct forecasts for the UK population (see economic and fiscal outlook, November 2020, paragraph 2.40).

- In the March 2020 economic and fiscal forecast, the OBR used the principal net migration variant and the zero net EU variants to produce a forecast to assess the economic impacts from the new immigration system.

- The 2016-based, 2018-based principal projections and the 2018-based zero net EU migration variant were used in the Fiscal Sustainability Reports (FSR's) to help the OBR assess the changes in the long-term projections. For further information see the chart 4.4, page 118 in the OBR's Fiscal sustainability report, July 2020

- A useful OBR interactive tool titled Choose your own long-term projections enables users to explore different population variants with different economic scenarios.

Outcomes

In the 2020 and later economic and fiscal forecasts, the OBR was able to produce projections based on the NPP variants that best captured the outlook for potential output based on published studies. This allowed the OBR to produce long-term projections without having to make specific judgments on the future population. In the FSRs, the OBR used the variant projections to assess demographic sensitivities in the long-term outlook of the public finances.

6 . Subnational population projections

Our 2018-based subnational population projections (SNPPs) included variants for the first time in one single release. We included variant projections featuring different levels of migration:

- a high international migration variant

- a low international migration variant

- an alternative internal migration variant

- a 10-year migration variant

The high and low international migration variants assume either higher or lower levels of net international migration to England as a whole, but the proportional distribution at local authority level remains the same. The result is that all areas see correspondingly higher or lower population totals, with areas that have high levels of international migration in the principal projection (especially parts of London) seeing the greatest difference.

We are aware that users have different views on how many years of data should be used to inform the projected population change at a local level. In general, we use five years of data, but in the 2018-based projections we used just two years of data for internal migration. This is because at the time of production we only had two years of data for internal migration available using the new Higher Education Leavers Methodology that was adopted.

For those who prefer five-year migration trend data, we produced the alternative internal migration variant, which uses five years of data for internal migration: two using the new method and three using the old method. We also produced a 10-year migration variant where all migration trends (internal, cross-border and international) are based on 10 years of data.

The advantages and disadvantages of using different numbers of years of input data are complex. More information and a comparison of the results of the principal projection, the alternative internal migration variant and the 10-year migration variant are discussed in our article on the Impact of different migration trend lengths.

The subnational population variant projections are under the data section on our main population projections release webpage. We have provided an interactive tool that shows the range of variant population projections by local authority for users to explore projections results including varying trend lengths for their area.

7 . Subnational population projections – local authority case study

Context

Local planning authorities need to provide a robust assessment of local housing need to help them plan as part of their fulfilment of the National Planning Policy Framework (NPPF). The new [standard method](#) uses household projections as a baseline for determining how much new housing a local authority needs.

Variant projections

In this case study, one local authority used the subnational population projections (SNPPs) variants rather than the household projection variants and applied aggregate household representative rates by age group from an earlier set of household projections to the SNPPs.

Purpose

This enabled an earlier and tentative indication of the household formation figure for the standard method calculation and the alternatives provided by the variants ahead of the release of the 2018-based household projections.

The local authority used the SNPP variants to understand the range of potential future populations in their area and the impact of each of these on potential house building requirements. Although the principal SNPP was viewed as the most likely scenario, the variant projections provided an alternative indication of likely future population growth or decline within a plausible range.

Outcome

The analysis helped to give a view on the potential house building requirements that may come out of future standard method calculations.

8 . Subnational population projections and household projections – Manchester City Council case studies

Context

The latest principal subnational projection for Manchester City Council assumed a much lower population growth from migration than has been seen in the city in subsequent years.

Variant projections

The subnational projections high migration variant is the preferred migration projection compared with the principal projection when official statistics are used by the local authority, for example, to inform the local government finance settlement.

Purpose

Manchester City Council felt that the high migration variant was more in line with other information from their local sources of data because of the following:

- Manchester's local data sources highlighting population growth being driven by new residents coming to the city to work prior to coronavirus (COVID-19), facilitated by an expanded residential housing programme

- Manchester's local information showing residents backfilling previously empty properties, leading to a record low vacancy rate across the city

- Manchester's local intelligence indicating that the number of students living in the area had also been higher than ever, with growth driven by international students, many of whom stayed in the city during the pandemic

Outcome

When Manchester City Council compared the principal population projection with the alternative migration scenarios, they considered the high migration variant to be more likely to represent the projection of the city's future population. The high migration variant was also used by Manchester City Council to feed into their own household projections because using the principal subnational projection risked underestimating future housing demand, ultimately deterring future investment in residential development in the city and reducing Manchester City Council's contribution to the government's national target of building 300,000 new homes annually.

9 . Household projections

The household projections typically include a range of variant projections. In the 2018-based household projections these were:

- a high international migration variant

- a low international migration variant

- an alternative internal migration variant

- a 10-year migration variant

- a projected household representative rates (HRR) variant, in which the HRR is projected 25 years on from the base year rather than being held constant from 2022 as in the principal projection; this allows us to see the potential effect on household formation if the recent trends we have observed continue into the future

These variants provide an indication of the future number of households in England under a range of alternative assumptions. The projected household representative rates (HRR) variant is particularly important to understanding the number of households that could be formed in an area. Although household formation is ultimately driven by housing supply, the use of variant household projections provides users with valuable insight into alternative patterns of household formation and potential future housing needs.

Detailed data for household projections variants are published in the Household projections for England: detailed data for modelling and analysis. Variant household projections can also be accessed through the Household Projections Analysis tool. This tool enables users to analyse the principal and variant household projections at local authority level.

10 . Subnational population projections and household projections – combined authorities case study

Context

A Local Housing Needs Assessment was commissioned by the West of England Combined Authority (WECA) and its constituent councils (Bath and North East Somerset, City of Bristol, South Gloucestershire and North Somerset) in partnership with North Somerset Council to understand and investigate current and future housing needs across the area.

Variants

The 2018-based alternative internal migration five-year trend, the 10-year migration variant and the projected household representative rates (HRR) variants were considered. The 10-year migration variant projections that were settled upon were modified to include the data from the 2019 mid-year population estimates so as to include the most up-to-date evidence available at the time.

Purpose

A growth analysis broken down by age and household type sought to provide robust evidence to support future plans. The period over which the trends are based was critical to the decision-making process, for example, the 10-year migration trend scenarios were deemed more likely to capture both highs and lows and were not as dependent on trends that may not be repeated. The two-year principal and the alternative five-year internal migration variants were discounted because short-term trends that were unduly high or low were felt unlikely to provide a robust basis for long-term planning.

The analysis included comparisons made between the projected number of households using the HRR between the years 2020 to 2030 and the 2018-based population projections for the two-year migration principal projection, five-year alternative internal migration variant and 10-year migration variant.

Outcome

The 2018-based subnational population and household projections variant analysis available in the West of England Combined Authority – Spatial Development Strategy showed that using the 10-year migration variant, projected a lower household change for two of the local authorities (Bath and North East Somerset, and South Gloucestershire) when based on a longer migration trend and a higher household change for the other two (City of Bristol and North Somerset).

11 . Where can I find information on variants methodology?

We have produced methodology documentation detailing each of the variants and how we produce the projections for national population projections (NPPs), subnational population projections (SNPPs) and Household projections. There are also population projections quality and methodology information (QMI) reports for the NPPs, SNPPs and Household projections and these contain information on the quality characteristics of the projections, as well as the methods used to create the data. Information on the assumption setting process is available in National population projections, how the assumptions are set: 2018-based.

12 . Concluding guidance on using variant projections

The variant projections presented in this user guide provide examples of where alternative scenarios have been used either as comparisons to the principal projections or used on their own to inform policy and planning requirements.

Demographic behaviour is inherently uncertain, and, in each case, particular variants have been used for a specific context. For example, because of a change in immigration policy, some users have felt that the zero net EU migration variant and age-related variants are helpful for understanding the sensitivities of public finances to possible future demographic change. In local planning, alternative migration variant trend lengths were considered more appropriate for local areas in assessing future housing needs.

Overall, the variant projections are helpful as an alternative to the principal projections for users who wish to understand the implications of future demographic scenarios for their specific purposes.

13 . Variants across the UK

Information on the availability of variant subnational population and household projections across the UK is available in Subnational population projections across the UK: a comparison of data sources and methods and Household projections across the UK: user guide.

14 . User feedback and support

We support users in their use of our variant projections and welcome feedback on our range of variants for population and household projections and future requirements, particularly when we begin to integrate Census 2021 data into our updates. Please let us know your thoughts by emailing pop.info@ons.gov.uk.

Further updates on the timing of future projections will be communicated in our quarterly Population and Migration Statistics newsletter. To sign up to this, please contact us at pop.info@ons.gov.uk.

15 . Future developments

The publication of the 2020-based interim national population projections (NPPs) is planned for December 2021, which is a principal projection-only release.

There are plans to include data from Census 2021 results in the release of the 2021-based NPPs where variant projections will be part of this release in early 2023 and in the 2021-based subnational population projections (SNPPs) (England) and 2021-based household projections (England) in summer 2023. However, we are unable to confirm exact timings at this stage.

We also plan to review the accuracy of the NPPs and variant projections, taking account of the planned revisions to the mid-2012 to mid-2020 population estimates at the national level, which is planned following the publication of 2021 Census data and other sources. This review, together with ongoing feedback from users, will help inform our approach to future population projections.

16 . Related links

National population projections: 2018-based
Bulletin | Released 21 October 2019
The potential future population size of the UK and its constituent countries. This is widely used in planning, for example, fiscal projections, health, education and pensions.

Subnational population projections for England: 2018-based
Bulletin | Released 24 March 2020
Indicate potential future population size of English local and health authorities. Widely used in planning – for example labour market, housing, health and education.

Household projections for England: 2018-based
Bulletin | Released 29 June 2020
Indication of the future number of households in England and its regions and local authorities. Used for planning in areas such as housing and social care.