

**Documentation of statistics for  
Population Projections 2018**

## 1 Introduction

Every year in February Statistics Denmark provides DREAM with updated data regarding immigration, emigration, live births, deaths and change in citizenship, which can be broken down by gender, age and ancestry. It is then DREAM who run the actual projection model for the whole of Denmark. Statistics Denmark and DREAM discuss the assumptions in the model regarding migration, fertility and mortality in order to assess whether changes in methodology are necessary. When the model is declared ready, DREAM provides Statistics Denmark with data. These data are both the foundation for the published statistics for the projection for the entire country as well as important background data for the regional models, which Statistics Denmark run.

Statistics Denmark has made population projections since 1963. In the beginning it didn't happen on an annual basis. With few exceptions annual projections has been made since 1978. Often several scenarios have been published. Now only one scenario is made with one set of assumptions.

From 2010 and onwards Statistics Denmark has made the projection for the entire country in cooperation with DREAM. The methods in the new common model were primarily based on DREAM's former projections. DREAM's experience with more advanced methods within eg mortality was an important reason why the common projection is based on DREAM's former projection. On [DREAM's](#) website there is thorough description in Danish of the methods within all the areas of the projection.

## 2 Statistical presentation

Statistics Denmark makes an annual population projection for Denmark in cooperation with the research institution DREAM. From a given set of conditions and assumptions Denmark's future population is calculated and broken down by gender, age and ancestry.

Based on the projection for the entire country Statistics Denmark makes a regional projection which can be broken down by gender, age, province and municipality. The projection by provinces and municipalities are not broken down by ancestry.

As a part of the projection, results are also available regarding changes in population concerning live births, deaths, immigration and emigration

## 2.1 Data description

Every year in February Statistics Denmark provides DREAM with updated data regarding immigration, emigration, live births, deaths and change in citizenship, which can be broken down by gender, age and ancestry. It is then DREAM who run the actual projection model for the whole of Denmark. Statistics Denmark and DREAM discuss the assumptions in the model regarding migration, fertility and mortality in order to assess whether changes in the methodology are necessary. When the model is declared ready, DREAM provides Statistics Denmark with data. These data are both the foundation for the published statistics for the projection for the entire country as well as important background data for the regional models, which Statistics Denmark run.

The projection for the entire country can be broken down by gender (men and women), age (single age levels from 0 to 109), ancestry (Danish origin, immigrants, descendants) and origin (Denmark, Western, non-Western) and year (2018-2060). The year 2018 contains actual population 1 January 2018. The years 2019-2060 are projected years referring to 01 January in the year.

The projection for provinces can be broken down by gender (men and women), age (single age levels from 0 to 99 and 100+), province (11 groups) and year (2018-2045).

The projection for municipalities can be broken down by gender (men and women), age (single age levels from 0 to 99 and 100+), municipality (98 groups) and year (2018-2045).

In 2015 Statistics Denmark launched a closer study of the population projection at local and regional level. The result of this work has led to some adjustments of the regional population projections. These adjustments has lead to a better population projection at regional level. For further information in Danish see [Statistics Denmark](#)

## 2.2 Classification system

The projections can be broken down geographically by Denmark, regions (5), provinces (11) and municipalities (98). The relation between the various geographic units can be seen [here](#).

## 2.3 Sector coverage

Not relevant for these statistics.

## **2.4 Statistical concepts and definitions**

**Ancestry:** In ancestry a person can be categorized as Danish origin, immigrant or descendant. A person has Danish origin if he or she has at least one parent who is both born in Denmark and has Danish citizenship. Neither immigrants nor descendants have that. The difference between the two is that descendants are born in Denmark while immigrants are born abroad.

**Immigration:** In the projection immigration only comprises persons who immigrate to Denmark during the year and who is still in the Danish population by the end of the year.

**Country of origin:** In the projection country of origin comprises the categories Denmark, Western countries and non-Western countries. Western countries include all 28 EU countries plus Andorra, Iceland, Liechtenstein, Monaco, Norway, San Marino, Switzerland, The Vatican, Canada, USA, Australia and New Zealand. Non-Western countries include all other countries.

**Emigration:** In the projection emigration only comprises persons who leave Denmark during the year and who haven't returned to Denmark by the end of the year.

## **2.5 Statistical unit**

Persons.

## **2.6 Statistical population**

The Danish population 01 January in all projected years.

## **2.7 Reference area**

There are three projections covering Denmark, 11 provinces and 98 municipalities respectively.

## **2.8 Time coverage**

A new projection is made every year. Each projection is a new statistic.

## **2.9 Base period**

The actual population 1 January 2018 is the foundation (or jump-off population) for the projections.

## **2.10 Unit of measure**

Persons.

## **2.11 Reference period**

The reference period for the 2018 projection is every single year in the projection period 2018-2060. Regarding the stock population the reference date is 1 January, while live births, deaths, immigration and emigration are flows during the year.

## **2.12 Frequency of dissemination**

Annually.

## **2.13 Legal acts and other agreements**

Population data are used as a foundation for the projections. The population data are based on the Danish CPR system, which can be used for statistical purposes in accordance with "Lov om Danmarks Statistik §6 (jf. lovbekendtgørelse nr. 599 af 22. juni 2000)".

## **2.14 Cost and burden**

These statistics are based on administrative data. There is thus no direct response burden in relation to the compilation of these statistics.

## **2.15 Comment**

[DREAM's](#) website.

[Statistics Denmark's](#) website

## **3 Statistical processing**

The projections are based on historical data about the population broken down by sex, age and ancestry as well as fertility, mortality and migration.

Assumptions about fertility, mortality and migration are also necessary in order to make the projections.

The projections are made once a year with the population 01 January as starting point (or jump-off population). They are published in the beginning of May.

In total three projections are made. One for the entire country, one for the 11 provinces (landsdele) and one for the 98 municipalities (kommuner).

### **3.1 Source data**

CPR (Centrale personregister) is the source for all the data used for the projections.

### **3.2 Frequency of data collection**

All data used as background data for the projections are annual data.

### **3.3 Data collection**

All population data come from the CPR-system, which is a register made for administrative purposes.

### **3.4 Data validation**

On [DREAM's](#) website there is a comprehensive documentation of the projection.

Further information can also be found on [Statistics Denmark's](#) website

### **3.5 Data compilation**

On [DREAM's](#) website there is a comprehensive documentation of the projection.

Further information can also be found on [Statistics Denmark's](#) website

### **3.6 Adjustment**

Not relevant for these statistics.

## **4 Relevance**

The projection for the entire country is made in cooperation with DREAM and constitute the population foundation for DREAM's economic projections.

The projection broken down by municipalities are also used extensively by municipalities and often forms the basis for the municipalities' own projections. These local projections often include a number of local factors, which are not included in DST's projection. DST's projection also has great interest in local media across the country.

### **4.1 User Needs**

Municipalities, regions, ministries, organizations, research institutions, private enterprises, news media and individuals are among the users of the population projections.

The projection for the entire country is made in cooperation with DREAM. DREAM uses the results themselves as the population input to their entire system of models. The final purpose for DREAM's models is to predict the long term development in the public finances

A number of companies offer local projections example COWI and KMD. DST's results from the municipal projections often form the basis for the municipalities own models, which some municipalities use to make projections with other scenarios. Some municipalities have expressed a wish to have more detailed projections than the municipality level, and they have asked Statistics Denmark to do that. However Statistics Denmark has estimated that the uncertainty would be too high for these kinds of projections. It is primarily uncertainty regarding internal migration which is the problem.

There are also users, who have asked about the possibility to have the projections by municipality broken down by ancestry. Due to the projections' demands for very detailed data, Statistics Denmark has estimated that most municipalities have too small immigrant and descendant populations to make such a breakdown possible. And Statistics Denmark do not make special projections for single municipalities, since the projections are a coherent system, where the projections for all the municipalities are done in one step, and where the totals are adjusted to the totals for the national projection.

## 4.2 User Satisfaction

No collection of information about user satisfaction is currently taking place regarding the projections.

In 2015 Statistics Denmark received two inquiries from municipalities, which argued that the projection of the municipalities was very inaccurate relative to the actual development, and that this had been going on for several years. Although there may exist significant differences between the projected and the actual population development, Statistics Denmark initiated a closer inspection of the population projection at local and regional level.

## 4.3 Data completeness rate

Not relevant for these statistics.

## 5 Accuracy and reliability

The uncertainty concerning the future number of live births, deaths, immigration and emigration - as a result of unexpected changes in the assumptions of the projection about fertility, mortality and migration - must be considered as giving rise to the most significant deviations between the projection and the actual development.

The population projection is deterministic and not stochastic. There is only one scenario and probabilities on different outcomes are not calculated.

### 5.1 Overall accuracy

Projections are subject to some uncertainty. The goal of the projection is primarily to give an idea of how the population will evolve given a number of assumptions. Whether these assumptions are in line with the actual development is uncertain. The uncertainty mainly concerns future immigration of foreign citizens and the proportion of the population which has not been born at the beginning of the projection period. This means that the uncertainty of the projection increases with time as a larger proportion of the population is made up of persons who have not been born at the start of the projection period.

The largest uncertainty attaches to the young age groups, i.e. those who have not been born at the start of the projection period. The size of the population in the oldest age groups is also subject to some uncertainty.

The uncertainty of immigration of foreign nationals is the largest uncertainty in the projection for the whole of Denmark. The largest uncertainty in the regional projection is the number of persons moving to the region from both other parts of Denmark and from outside of Denmark.

It is assumed in the regional projection that the current pattern based on historical data for the past four years will remain throughout the projection period.

The projections are deterministic, that is, based on historical experience. The projection includes only one scenario for future developments. Uncertainty is an important factor, but the uncertainty is not calculated and is also not possible to calculate in the current projection model.

The future number of live births is to a considerable extent decided by the presumed development of the fertility. This means that this variable is subject to considerable uncertainty due to the unpredictability of the future development in fertility. This affects, for example, the number of

children in preschool-ages six years into the horizon.

The future number of deaths is subject to some uncertainty. For a long time there has been a clear falling trend in mortality. Mortality is therefore considered somewhat easier to project compared to fertility and migration. Deviations in this component affect mainly the elderly population.

Immigration is subject to considerable uncertainty due to considerable fluctuations and the unpredictability of migrations. It is particularly immigration for non-Nationals that is difficult to predict. Conditions within Denmark and outside of Denmark will affect the number of persons that immigrates.

Emigration is subject to some uncertainty due to considerable fluctuations and the unpredictability of migrations. The uncertainty of emigration is also due to uncertainty about future immigration. Many immigrants emigrate relatively soon after their arrival. A high number of immigrants will therefore also result in a high number of emigrants.

The uncertainty about migration between municipalities in Denmark is important. The number of persons moving to or from a municipality is affected by job opportunities, housing supply and economy. If the projection for Denmark as a whole is under- or overestimated, this will affect the local projections, so that these also are under- or overestimated. Particularly in 2015 this was the case when the number of refugees was underestimated. Because the regional projection model uses an average of four years, it will not reflect a trend. If a municipality has a sharply rising or falling population, the model will even out this development. Since the projection should go about 25 years ahead, it is fair to use a more conservative approach compared to the population growth /reduction.

The municipal projection is "mechanical" in the sense that it does not involve factors that are beyond the purely demographic conditions. The demographic consequences of the decision of increased building of housing are as an example not included. Statistics Denmark's population projection has the very important restriction that the sum of municipalities must sum to the projection for the whole of Denmark. It is not possible to add population into one municipality, without removing the same number from another municipality.

## 5.2 Sampling error

Not relevant for these statistics.

## 5.3 Non-sampling error

The projection's purpose is to give some estimates for the future population. An exercise that is by nature filled with uncertainty.

If the actual development differs from the assumptions in the model, which it definitely will to some extent, the future population will also differ from the population in the projection.

Assumptions for the 2018-projection for the entire country:

Total Fertility:

Long term fertility levels for all groups of origin are assumed. They are as follows:

- Danish origin - Danish citizenship: 1.91
- Danish origin - foreign citizenship: 1.91
- Immigrants non-Western countries - Danish citizenship: 1.68
- Immigrants non-Western countries - foreign citizenship: 1.97



- Immigrants Western countries - Danish citizenship: 1.61
- Immigrants Western countries - foreign citizenship: 1.77
- Descendants from non-Western countries - Danish citizenship: 1.91
- Descendants from non-Western countries - foreign citizenship: 1.91
- Descendants from Western countries - Danish citizenship: 1.75
- Descendants from Western countries - foreign citizenship: 1.75

#### Origin at birth:

Some of the children born by immigrant- and descendant women will belong to the group of persons with Danish origin, because one of the parents belongs to this group. Therefore, the so-called frequencies of change have been calculated for immigrants and descendants based on the period 2015-2017. The following frequencies state the percentage of new-borns from the groups of immigrants and descendants, that will be classified in the group of persons with Danish origin.

- Danish origin - Danish citizenship: 100
- Danish origin - foreign citizenship: 100
- Immigrants from non-Western countries - Danish citizenship: 24.5
- Immigrants from non-Western countries - foreign citizenship: 21.8
- Immigrants from Western countries - Danish citizenship: 73.1
- Immigrants from Western countries - foreign citizenship: 36.4
- Descendants from non-Western countries - Danish citizenship: 100
- Descendants from non-Western countries - foreign citizenship: 41.4
- Descendants from Western countries - Danish citizenship: 100
- Descendants from Western countries - foreign citizenship: 66.3

#### Mortality:

Mortality rates are projected using a variant of the Lee Carter method. In 2059 the life expectancy at birth is projected to be 87.1 for men and 89.5 for women. The same assumptions for mortality have been used for all groups of origin.

#### Immigration:

Reimmigration rates based on the period 2015-2017 are used in the entire projection period regarding immigration for persons with Danish origin, descendants and immigrants with Danish citizenship.

When it comes to future immigration, the immigration of immigrants without Danish citizenship forms the largest uncertainty. It has been assumed, for non-western immigrants, that immigration in the first projection year - ie 2018 will be equivalent to 1,000 refugees, 2,900 family reunifications plus an average of the remaining immigration from 2015 to 2017. In 2019 it has been assumed an immigration of 1,000 refugees plus an average of the remaining immigration from 2015 to 2017. The figures are then adjusted gradually into the long-term level of 17,000.

Immigration of western immigrants without Danish citizenship has initially been set as the average level from 2015-2017, adjusted gradually to the long-term level of 28,100.

#### Emigration:

Emigration rates based on the period 2015-2017 are used in the entire projection period for all groups of origin.

Assumptions for the 2018-projection for the 11 provinces:

#### Fertility:

Fertility rates are calculated for all 11 provinces based on data for the period 2014-2017. Future developments in fertility are given by the national projection, and geographical differences from the starting point are upheld throughout the projection period via an adjustment procedure.

#### Deaths:

Mortality rates are calculated for all 11 provinces based on latest available data (2013/2017). Future developments in mortality are given by the national projection, and geographical differences from the starting point are upheld throughout the projection period via an adjustment procedure.

#### Migration out of the province:

Rates are calculated for all 11 provinces based on data for the period 2014-2017. Rates are assumed to be the same in the entire projection period.

#### Migration into the province:

The estimated number of refugees in 2018 and 2019 is allocated on the basis of regional Allocation of Refugees. Quotas for 2019 is not known, therefore the 2018 year share from the quotas are used for both years.

The persons immigrated on the basis of family reunification are distributed between provinces as refugees have been distributed over the last four years. Gender and age distribution is set to match the pattern of family reunions over the last four years

Other persons moving to a region is calculated from the regions share of other in migrations in the period 2014-2017. The number of persons moving to a region is not distinguished by the number from within Denmark and immigrations.

#### Fertility:

Fertility rates are calculated for all 98 municipalities based on data for the period 2014-2017. They are subsequently smoothed keeping total fertility for the municipality at the same level. Future developments in fertility are given by the national projection, and geographical differences from the starting point are upheld throughout the projection period via an adjustment procedure.

#### Deaths:

Mortality rates are not calculated at the municipal level. It is assumed that every municipality has the same mortality rates as the province it is a part of.

#### Migration out of the municipality:

Rates are calculated for all 98 municipalities based on data for the period 2014-2017. Rates are assumed to be the same in the entire projection period.

#### Migration into the municipality:

The estimated number of refugees in 2018 and 2019 is allocated on the basis of regional Allocation of Refugees. Quotas for 2019 is not known, therefore the 2018 year share from the quotas are used for both years.

The persons immigrated on the basis of family reunification are distributed between municipalities as refugees have been distributed over the last four years. Gender and age distribution is set to match the pattern of family reunions over the last four years

Other persons moving to a municipalities is calculated from the municipalities share of other in migrations in the period 2014-2017.

#### **5.4 Quality management**

Statistics Denmark follows the recommendations on organisation and management of quality given in the Code of Practice for European Statistics (CoP) and the implementation guidelines given in the Quality Assurance Framework of the European Statistical System (QAF). A Working Group on Quality and a central quality assurance function have been established to continuously carry through control of products and processes.

#### **5.5 Quality assurance**

Statistics Denmark follows the principles in the Code of Practice for European Statistics (CoP) and uses the Quality Assurance Framework of the European Statistical System (QAF) for the implementation of the principles. This involves continuous decentralized and central control of products and processes based on documentation following international standards. The central quality assurance function reports to the Working Group on Quality. Reports include suggestions for improvement that are assessed, decided and subsequently implemented.

#### **5.6 Quality assessment**

The main purpose of the projection is to show how the population will develop given the jump-off population and a set of assumptions. Whether these assumption will be in accordance with the actual development is of course uncertain. The uncertainty is higher the further ahead in the future the projected year is.

In the projection for the entire country uncertainty about future immigration of foreign citizens and future levels of fertility are most important to be aware of.

Regarding the projections on provinces and municipalities it is in particular uncertainty about internal migration one should be aware of. It is assumed in the projections that the current internal migration pattern based on data for the last four years will remain at the same level throughout the projection period.

The projections are deterministic and thus only have one scenario for the future development. Uncertainty is however an important factor, but uncertainty is not calculated and it is not possible to calculate with the current projection models.

#### **5.7 Data revision - policy**

Statistics Denmark revises published figures in accordance with the [Revision Policy for Statistics Denmark](#). The common procedures and principles of the Revision Policy are for some statistics supplemented by a specific revision practice.

#### **5.8 Data revision practice**

The published figures are definitive for the projection of the year concerned.

## **6 Timeliness and punctuality**

The statistic was published on time.

### **6.1 Timeliness and time lag - final results**

The projection is published annually in the beginning of May. The data used in the projections is available in the middle of February.

### **6.2 Punctuality**

These statistics are published without delay, with reference to the announced time of publication in the release calendar.

## **7 Comparability**

Each projection is a new statistics and is not meant to be used with former years projections.

In 2010 Statistics Denmark made a common projection with DREAM for the first time. With the new common projection the projection model was changed. The new model was primarily based on DREAM's former model.

### **7.1 Comparability - geographical**

The projections on provinces and municipalities are made in the same way for all the provinces and municipalities, and the results are therefore comparable.

Eurostat makes it's own population projections for all the EU-countries including Denmark. Results from two different projections will always differ, due to the fact that there is an almost unlimited number of possibilities regarding the assumptions. The results from Eurostat's projections are therefore different from the results from Statistics Denmark's projection.

### **7.2 Comparability over time**

When comparing results from two different projections one should be aware that the assumptions and jump-off population changes from year to year. The latest projection is always the most updated one.

### **7.3 Coherence - cross domain**

The migration concept used in the projections differs from other statistics.

Immigration in the projections includes persons, who were not in Denmark by the beginning of the year, who immigrate during the year and who are in Denmark by the end of the year. Emigration in the projections includes persons, who were in Denmark by the beginning of the year, who emigrate during the year and who are not in Denmark by the end of the year. Immigration and emigration are therefore different from the disseminated numbers for migration, where all the flows are counted. Including for example immigrants who emigrate before the end of the year.

The population in the projection is broken down by year of birth. Therefore the age regarding deaths and migrated is calculated as age by the end of the year and not as age by the time of death or migration.

### **7.4 Coherence - internal**

The projections for the entire country, provinces and municipalities are three different projections. However coherence is achieved by adjusting the levels in the projection by provinces and municipalities to the levels in the projection for the entire country.

Some very small differences still exist due to rounding.

## **8 Accessibility and clarity**

Results from the projections are published on Statistics Denmark's Statbank. On the same day a newsletter is published. Results from the projections are also published in Statistical Yearbook.

### **8.1 Release calendar**

The publication date appears in the release calendar. The date is confirmed in the weeks before.

### **8.2 Release calendar access**

The Release Calendar can be accessed on our English website: [Release Calendar](#).

### **8.3 User access**

Statistics are always published at 8:00 a.m. at the day announced in the release calendar. No one outside of Statistics Denmark can access the statistics before they are published.

### **8.4 News release**

A news letter from Statistics Denmark is released when the projection is made public.

The news letter is only available in Danish. News letters can be accessed from Statistics Denmark's news letters [overview](#) by selecting Befolkning og Befolkningsfremskrivninger.

## 8.5 Publications

In [Statistical Yearbook](#) results from the latest projection are shown in the section Population and elections.

## 8.6 On-line database

The statistics are published in the StatBank under the subject in the following tables:

- [FRDK118](#): Population projections 2018 for the country by ancestry, sex, age and time
- [FRDK218](#): Key figures 2018: Summary components of changes according to population projection by ancestry, type of movement and time
- [FRDK318](#): Assumptions of fertility for the population projection 2018 by age, ancestry and time
- [FRDK418](#): Assumptions of mortality for the population projection 2018 by sex, age, life table and time
- [FRDK518](#): Assumptions of migrations for the population projection 2018 by sex, age, ancestry, movement and time
- [FRLD118](#): Population projections 2018 by region, age, sex and time
- [FRLD218](#): Key figures 2018: Summary components of changes according to population projection by region, type of movement and time
- [FRKM118](#): Population projections 2018 by region, age, sex and time
- [FRKM218](#): Key figures 2018: Summary components of changes according to population projections for municipalities

## 8.7 Micro-data access

The annual version of the projection is stored in aggregated data sets containing information about persons by population groups, sex, one-year age groups and year of the projection. Micro-data is not relevant concerning the projections.

## 8.8 Other

Not relevant for these statistics.

## 8.9 Confidentiality - policy

Confidentiality is not an issue regarding the projections. The future population is calculated and cannot be broken down to individuals.

## 8.10 Confidentiality - data treatment

Confidentiality is not an issue regarding the projections. The numbers are calculated and cannot be broken down by individuals.

## 8.11 Documentation on methodology

The projection is a result of a cooperation between Statistics Denmark and DREAM. A thorough documentation (in Danish) is available via [DREAM's](#) website.

## **8.12 Quality documentation**

Results from the quality evaluation of products and selected processes are available in detail for each statistics and in summary reports for the Working Group on Quality.

## **9 Contact**

The administrative placement of these statistics is in the division of Population and Education. The person responsible is Annika Klintefelt, tel. +45 39 17 36 78, e-mail: akf@dst.dk

### **9.1 Contact organisation**

Statistics Denmark

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