

DAPPS: A New Tool for Demographic Analysis and Population Projections

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The U.S. Census Bureau has developed a new software application, Demographic Analysis and Population Projections System (DAPPS). DAPPS applies the cohort component projections technique to produce single year population projections. Cohort component projection is a method widely used by National Statistics Offices to produce their official national population projections. DAPPS has a modern graphical user interface that walks users step-by-step through the process of applying demographic analysis techniques and producing population projections. It allows users to enter a variety of inputs for population, fertility, mortality, and migration, and produces a range of outputs for users to evaluate. It serves as a user-friendly platform for inputting and analyzing the data, and producing and evaluating population projections.

Introduction

The cohort component projection method is widely used by National Statistics Offices to produce official national population projections. To assist countries in producing their population projections, the U.S. Census Bureau first created the Rural-Urban Projections (RUP) software program in the 1980s. The strengths of RUP were that it used well-tested algorithms for population projections and that it allowed for a variety of inputs and outputs. However, it was difficult to use; it relied on character string inputs that had to be properly formatted in a specific sequence. Furthermore, when producing a set of population projections, countries needed to first conduct demographic analysis to prepare inputs to the projection. For this process, the U.S. Census Bureau had developed a set of Excel spreadsheet templates, the Population Analysis System (PAS) (<https://www.census.gov/data/software/pas.html>). The spreadsheets are useful, but requires analysts to move back and forth between the spreadsheets and the RUP program, creating potentials for error. Furthermore, because each spreadsheet needed to be saved as separate files, problems occurred with version control and file management.

In this paper, we introduce a new software, Demographic Analysis and Population Projections System (DAPPS)(<https://www.census.gov/data/software/dapps.html>). DAPPS has a user-friendly interface that runs the RUP program in the background, taking advantage of the strengths of the RUP engine, but easy to use. While other software for population projections like MORTPAK and Spectrum are available, DAPPS allows for more flexibility in inputs for users. Furthermore, DAPPS integrates demographic analysis and population projections into one software application so that users can have a one-stop tool to conduct both demographic analysis and produce population projections.

Methodology

The cohort component projection method has been in use for almost a century (for example, Bowley, 1924; Whelpton, 1928). The technique is based on the balancing equation where population at a future date is equal to the population at the current date plus births, minus deaths, and net migration. The method starts with a population by age and sex, then uses the components of demographic change (births, deaths and net migration) to project the population forward.

DAPPS applies the cohort component projections technique to project midyear populations one year at a time using calendar-year events. The base population may be in one- or five-year age groups by sex. When five-year age groups are entered, DAPPS splits them into one-year age groups using the Beers method (Beers, 1945). Rather than using survival ratios, DAPPS uses age-specific death rates to compute deaths. Further details on the projection method used by DAPPS is described elsewhere (U.S. Census Bureau, 2013).

To create a projection, DAPPS requires at least three components: a base population by age and sex, age-specific mortality rates by sex or a lifetable, and age-specific fertility rates. A fourth optional input is a pattern of net migration by age and sex of migrant.

The demographic analysis tools of DAPPS may be used to evaluate and/or adjust data inputs and to project fertility and mortality. DAPPS incorporates tools included in the PAS spreadsheets under one program. The built-in features included in DAPPS allow users to smooth age distributions, evaluate and adjust undercount of children under 10, extrapolate total fertility rates using a logistic or sine function, to project life expectancy either through a fixed-slope or fitted logistic function, among others. The demographic analysis tools included in DAPPS are described in a separate document (Arriaga, 1994).

DAPPS Graphical User Interface

The graphical user interface (GUI) for DAPPS facilitates the input of data, the use of its analysis tools, and the creation of population projections. DAPPS stores its inputs and outputs using a portfolio. This encourages all the inputs used in and outputs returned from a series of projections to be kept together and available after the portfolio is closed and reopened. Analysts working on multiple projections for different countries or regions can keep their work separate and have a record of the processes that they used to create a series of projections.

The DAPPS GUI is organized into four tabs: Home, Input, Analysis, and Projection. Within the Input tab, users enter data for population, fertility, mortality, and migration. Users have options on the types and format of data to enter under each component (Figure 1). DAPPS also allows users to enter multiple inputs for each component, providing users the flexibility to use various data sources.

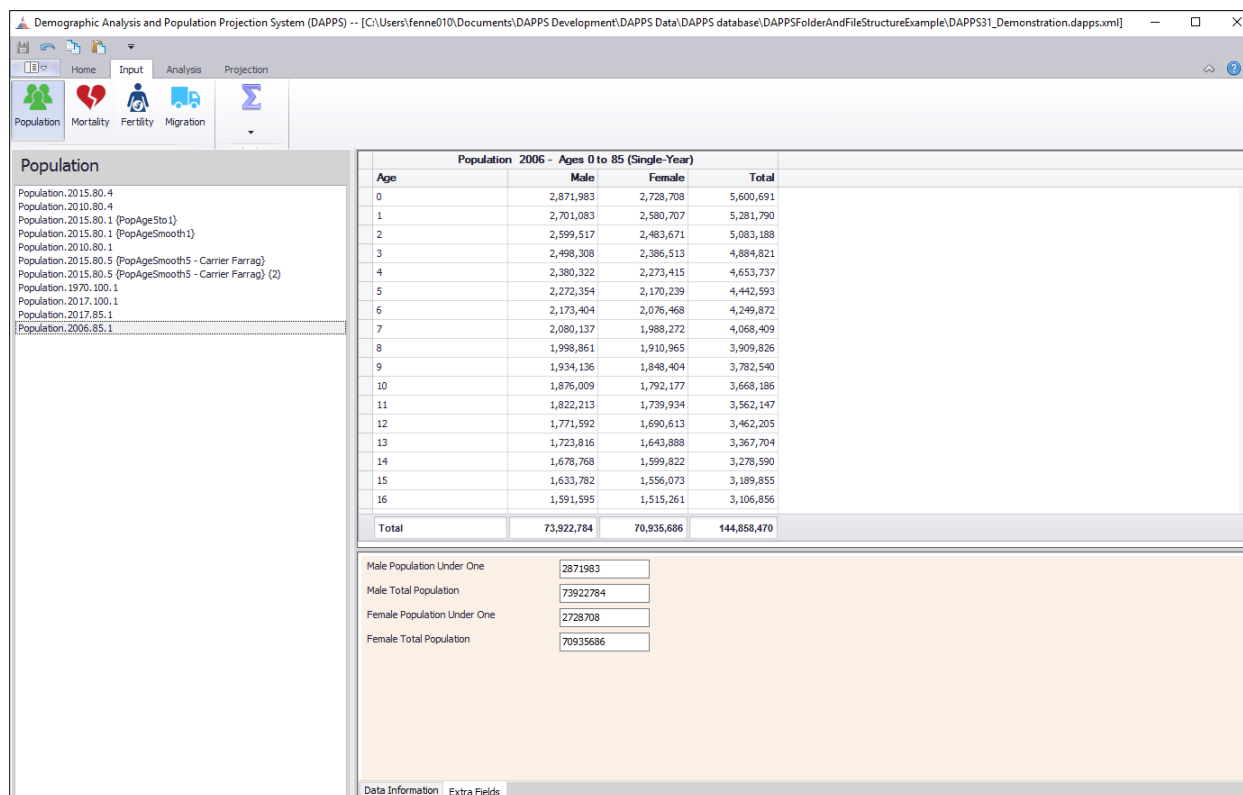


Figure 1. Input tab is used to enter data for population, mortality, fertility, and migration. Example showing population of Nigeria, 2006 from International Data Base (<https://www.census.gov/data-tools/demo/idb/informationGateway.php>).

The Analysis tab allows users to apply demographic analysis methods to the inputs and to the projections produced in DAPPS. Available tools include age-sex smoothing, adjusting the population for undercount of children under ten years, the P/F Ratio technique for adjusting age-specific fertility rates, interpolation and extrapolation of total fertility rates and life expectancy, and comparison of population projections to the census population counts. The analysis features in DAPPS walks users through a series of windows allowing them to enter inputs and specifications for each technique. Outputs from the demographic analysis tools are stored under the Analysis tab in a column on the left hand side of the screen for analysts to evaluate (see Figure 2). The results can be used directly as inputs for projections.

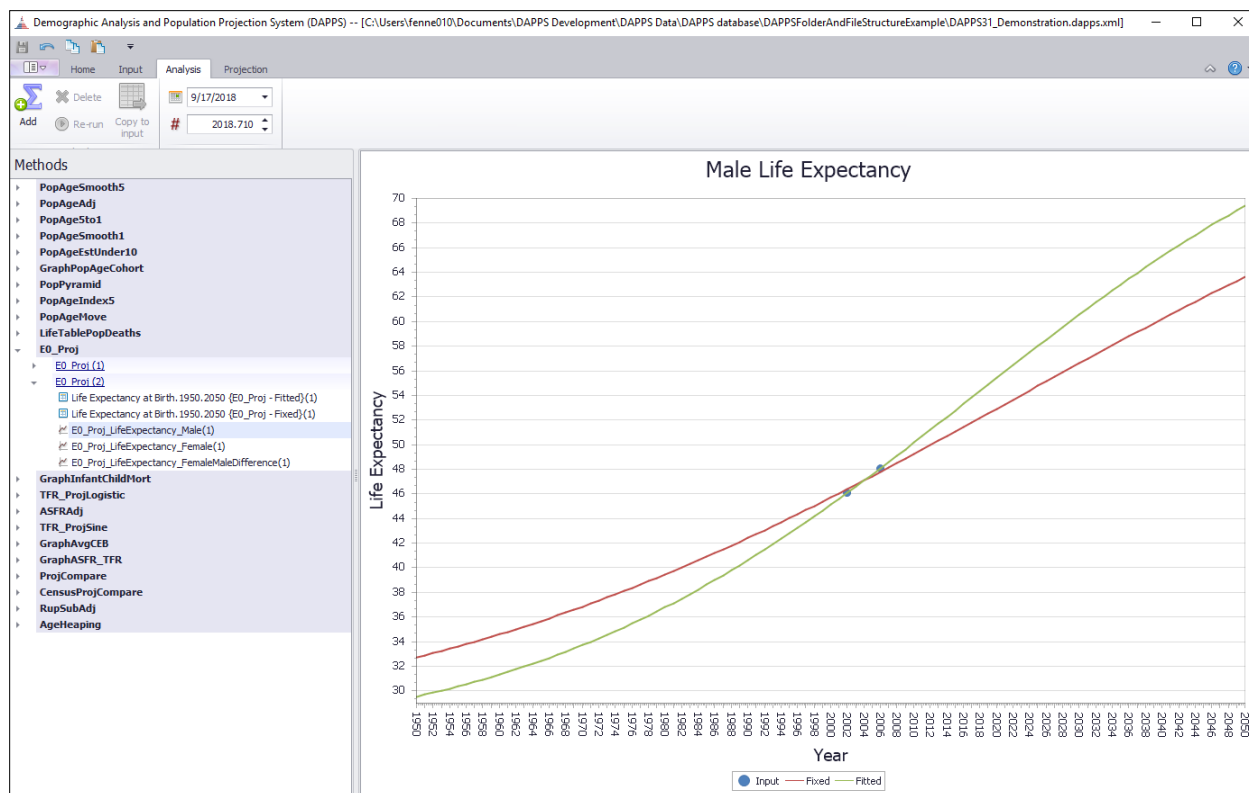


Figure 2. Analysis tab features tools for demographic analysis. Example showing projected life expectancy in Nigeria from International Data Base (<https://www.census.gov/data-tools/demo/idb/informationGateway.php>).

The Projection tab creates population projections and displays complete outputs, including charts and tables for each component of a projection. When creating a projection, users can select the components on a series of sub-tabs designed to mirror the steps an analyst might progress when creating a population projection. DAPPS produces charts and tables for each projection allowing users to examine and evaluate the outputs of the projections. The outputs of the projections are organized in a column on the left hand side of the screen by each projection. The analysts can label the projections in a way that would be easily identifiable. Under each projection, the outputs are organized by charts and tables.

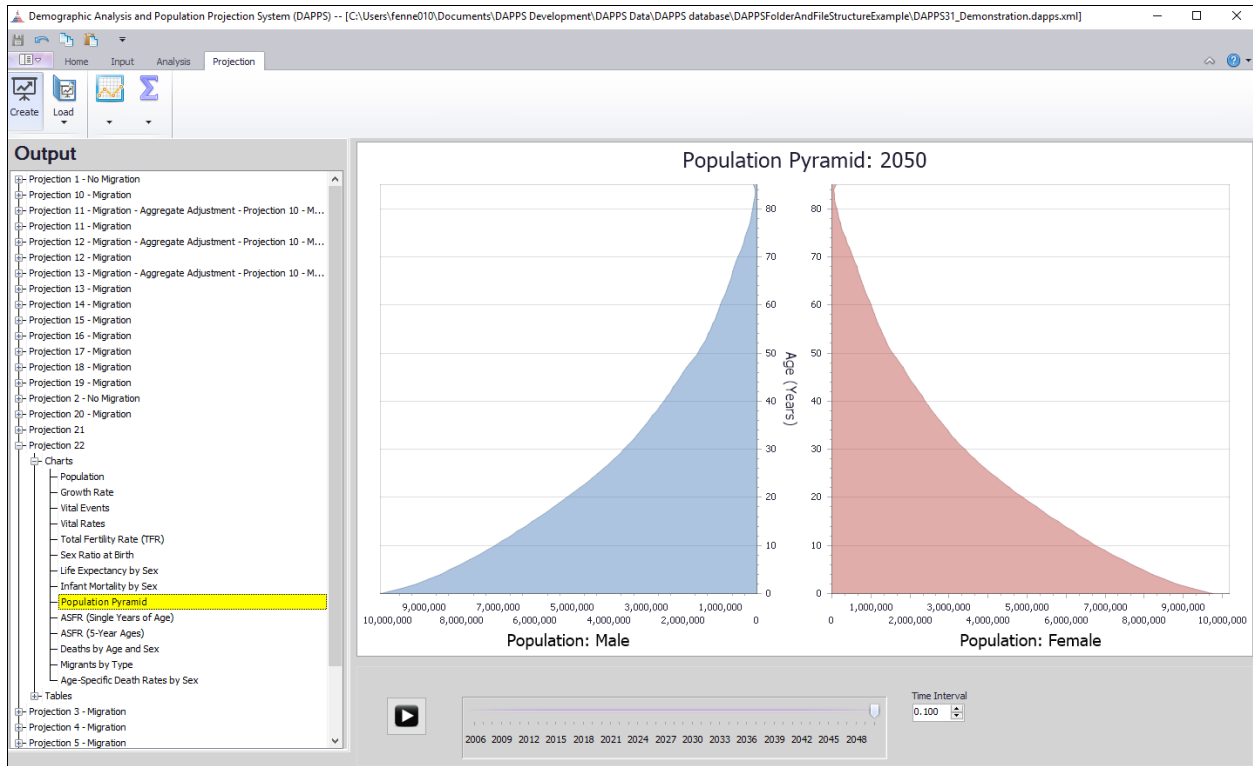


Figure 3. Projection tab shows outputs from a projection in charts and tables. Example showing population pyramid of Nigeria with projection population in 2050, International Data Base (<https://www.census.gov/data-tools/demo/idb/informationGateway.php>).

Conclusion

DAPPS is a user-friendly tool that walks users step-by-step through the processes of applying demographic analysis techniques and producing population projections. It harnesses the power of the well-tested cohort-component projection program, RUP, with a modern graphical user interface.

References

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