Population Projections Methodology (2019 Baseline)

Introduction

The California Department of Finance (DOF), Demographic Research Unit is responsible by statute for maintaining postcensal population projections which are calculated using the demographic balancing equation:

$$Current\ Population = Previous\ Population + (Births - Deaths) + Net\ Migration$$

This method calculates the population in the target year by starting with the population from the previous year, adding natural increase (births minus deaths) and net migration that occurred between the two years. The births, deaths, and migration anticipated during this time are called the components of change. A cohort-component method traces people born in a given year throughout their lives. As each year passes, cohorts change due to the mortality and migration assumptions. Applying fertility assumptions to women of childbearing age forms new cohorts at age zero. Events are simulated for the population in households in the following order: births, deaths, in-migration, out-migration. Then all individuals, except new births and special populations, are aged forward one year to simulate the process of aging. The special populations, such as group quarters (GQ) population, are adjusted to agree with DOF's estimated change in each county-level GQ population and that population is added to the household population to complete the starting total population for the next year's projection.

The 2019 baseline projections incorporate the latest historical population, birth, death, and migration data available as of December 2019 for information through July 1, 2019. Historical trends from 1990 through 2019 for births, deaths, and migration are examined. County populations by age, sex, and race/ethnicity are projected to 2060. The county projections are summed to obtain state totals. Please note, these projections were published before the Coronavirus Disease 2019 (COVID-19) pandemic and do not reflect any possible effects on future economic and demographic trends.

Summary of results

The total population for California will slowly grow from 40.1 million people in 2020 to 45.3 million residents in 2060, a change of 13 percent over 40 years. California's annual growth rate is expected to decline, but remain positive, throughout the projection period.

Births are expected to continue declining, leveling off after 2050. The increases in births to older women will not be enough to offset the downward trends in younger women. The total number of deaths grows during the projections period driven by the aging of the youngest baby boomers to 95 years old by 2060. Although net migration was negative in 2018 and 2019, it is projected to return to a positive figure and grow to approximately 100,000 migrants during 2024-2025. Starting in 2025, the gross migration ratios by age are held constant throughout the projection period causing net migration to grow from almost 100,000 people in 2025 to 108,000 migrants in 2060.

Due to these trends, the natural increase of population (births minus deaths) is forecast to become negative in 2043. From that point onward, net population growth will be solely due to migration. The continued aging of the baby boom and the lack of replacement births will cause the median age to rise from 37.4 years in 2020 to 44.3 years in 2060.

Assumptions and Limitations

Projection models heavily rely on trends and relationships observed in the past. Users are cautioned that projections may not accurately project the future population of the state or the counties when future events do not follow past trends. These projections should be used with an awareness of events that have taken place since their publication.

The following general assumptions guided decisions while developing these projections. Specific assumptions for each component of change are discussed later.

- These projections were published before the COVID-19 pandemic and do not reflect any possible effects on future economic and demographic trends.
- These projections assume economic stability throughout the forecast period.
- Changes in immigration, education, housing, or transportation policy could have significant effects and are not considered here.
- People have the right to migrate where they choose within the United States.
- The international immigration rules are stable, as are the global economic conditions that drive migration.
- Resource constraints such as water, housing, and transportation capacity grow at a sufficient pace to accommodate projected population growth.
- There are no unforeseen changes in productivity and technology (particularly reproductive technology and healthcare).
- No major natural catastrophes or wars will befall the state or the nation.

Data and Methods

1. Base Population

The basis of the DOF 2019 population projection series is the April 1, 2010, decennial census population count of 37,253,956 by age, sex, and race/ethnicity for California. The race/ethnicity groups presented in this report are the Non-Hispanic Races: White; Black; American Indian or Alaska Native; Asian; Native Hawaiian or Pacific Islander; Multiracial; and Total Hispanic ethnicity of any race.

2. Fertility

Trends: Births are expected to continue to decline throughout the projections period, leveling off after 2050. Births begin at 459,000 in 2019-2020 and decline to 424,000 in 2059-2060. The total fertility rate for California has been below the replacement level of 2.1 births per woman since 2009 and it will drop to 1.5 children per woman in 2040. This level of fertility puts California in the company of European countries like Spain and Italy which have had a similarly low total fertility rate (TFR) since the 1970s.

Data Source: Records of births, including selected characteristics of children and parents, for 1990 to 2019 are obtained under an agreement with the California Department of Public Health. Data were evaluated for quality. Missing values in birth records were filled-in using hotdeck imputation where the missing value was pulled from a randomly selected similar record

Methods: Using historical birth data since 1990, fertility trends are calculated for females by age and race/ethnicity cohort in each county. In projecting future births, there are two key considerations for each year of the projections period: (1) the age and race/ethnic structure of the female population and (2) the fertility rate that will be applied to each cohort a given year. The number of births after July 1, 2019, is determined by applying the projected fertility rate to the projected population for females by age and race/ethnicity. Fertility rates are calculated by the number of births during the year divided by the midyear population of women in each age cohort. The fertility model uses the race/ethnicity of mothers to assign the race/ethnicity to their children. Children are assigned a slightly higher probability of male sex (105 males per 100 females). Births generate a new population cohort at age zero which is added to the projections dataset.

Specific Assumptions and Decisions: It is assumed there will be a continuation of declining fertility for cohorts under 30, stable fertility for those 30-34 years of age, and continued modest increases in fertility for women 35-44 years old. The fertility increases in the oldest cohorts are not enough to offset the downward trends in the younger cohorts.

During the projections review process, decisions were made to override the median projected rate in favor of higher or lower rates to achieve a county-level target for the total fertility rate. We found that some counties had very recent changes in fertility, so used a decaying linear or exponential weight as a function of N years back from the most current year to give more or less weight to the latest data. Modestly higher TFR for ages above 30 were allowed for these counties: Marin, Plumas, San Francisco, and Santa Clara. We also used exponential weights for prime childbearing ages under 30 in Butte, Marin, Mono, Modoc, Siskiyou, and Trinity Counties to reflect the continuation of recent rapid declines in fertility.

3. Mortality

Trends: Deaths are expected to rise during the projections period from 276,000 in 2019 to 489,000 in 2060. The rising deaths are a result of the aging of the baby boomers who will all be over 95 years old by the end of the forecast period.

Data Source: Records of deaths, including selected characteristics of the deceased, are obtained under an agreement with the California Department of Public Health. Data were evaluated for quality. Missing values in death records were filled-in using hot deck imputation where the missing value was pulled from a randomly selected similar record. Age values were verified against birthdate. If age is missing or very high, the age based on the birthdate was used.

Methods: Using historical mortality since 1990, mortality trends are calculated for each sex, age, and race/ethnicity cohort in each county. In projecting deaths, there are two key considerations for each year of the projections period: (1) the sex, age, and race/ethnic structure of the population, and (2) the mortality rate that will be applied to each cohort in any given year. Mortality rates are calculated when the number of deaths in a given cohort during the year is divided by the midyear population in that cohort.

Specific Assumptions and Decisions: While gains in life expectancy are expected during the projection period, improvements in mortality have slowed somewhat in recent years and this is reflected in the projections series.

During the projections review process, decisions are made that may override the median projected rate in favor of a higher or lower rate to achieve a county-level target for life expectancy at birth.

To reflect the slowdown of improvements in life expectancy, higher than median mortality rates for older ages were used in all counties except Glenn, Nevada, San Joaquin, San Luis Obispo, Santa Barbara, Siskiyou, and Tuolumne. On the other hand, lower mortality rates for younger ages were applied in most counties, except for Fresno and Merced (only newborns), and Solano and Tuolumne. This was done to reflect recent mortality improvements in younger ages.

4. Migration

Trends: Migration is the most critical component of California's population change and the hardest to project due to inherent variability and the absence of full administrative data. Although net migration for California has been negative for 2018 (-39,476) and 2019 (-13,074), migration is forecast to return to the decade's average by 2025. This results in net migration of approximately 100,000 migrants during 2024-2025. Net migration is thus expected to return to a crude rate of net migration of about 2.5 persons per 1,000 population by 2025 and remain stable throughout the forecast period. Net migration will be large enough to counterbalance the negative natural increase resulting in small, annual population growth for the state.

Data Sources: Historical migration trends are based on the DOF estimated county net domestic and net foreign migration from the July 1 components of change in the Reports E-2 and E-6 State and County Population estimates series published in December 2019. Each net flow is then disaggregated into four different flows - domestic in and out and foreign in and out - using administrative data. Administrative

records include driver's license address changes, IRS tax return data, Medicare and Medi-Cal enrollment, federal immigration reports, elementary school enrollments, and group quarters population. All data used to develop these flows are in summary tables and do not reveal the identity of any individual. Gross migrants from California to outside of the United States are calculated as the residual between estimated foreign in-migration and net foreign migration.

Methods: The DOF estimates method does not generate the age, sex, or race/ethnicity detail of net migrants. These are generated by first setting a base age distribution using the American Community Survey (ACS) Tables B07001 and B07401 for each year and then adding or subtracting records for the characteristics of individuals who move within, into, or out of California during the postcensal estimates from 2010 to 2019 for each flow.

To assign sex and race/ethnicity characteristics for gross in-flows for both domestic in-migration to California from another U.S. state and foreign immigration, observations are randomly selected from the ACS Public Use Microdata Sample (PUMS) data for each year from each migration flow/age cohort and are added to the projections dataset. For example, if there are 500 expected in-migrants in the 35-39 age group to a given county from other US states, the model would pull the equivalent of 500 randomly selected persons from the records of ACS respondents who were between age 35 and 39, inclusively, and reported moving into the county from another state. A record for each selected individual's sex, race/ethnicity, and detailed age would be added to the projections dataset.

For county-to-county migration within California, the same procedure is used to add the individual to the projections dataset for the receiving county while a similar record is removed from the donating county.

For gross out-flows, observations are dropped from the projections dataset. The traits of domestic out-migrants are determined similarly to domestic in-migrants using the ACS PUMS. Migrants are randomly identified from the population of migrants from California to another US state by age, sex, and race/ethnicity.

In the case of foreign out-migration, the age structure is determined using the ACS PUMS rather than the ACS summary tables. Emigrants are generated using estimated gross emigration rates by sex, place of birth, and length of time in the US. The latest data for the 2016 age profile comes from the 2014-2018 ACS (5-year file). The age profiles (the number of foreign out-migrants by age divided by the county population in that age group) are carried forward to the last postcensal year from the latest available ACS data. Out-migrants are selected from the ACS based only on age.

Once the projections dataset for the postcensal (2010-2019) years has been populated for migration, the domestic in- and out- and foreign in-migration rates are calculated for each age, sex, and race/ethnicity cohort in each county. Foreign out-migrants are identified based on age-specific gross migration rates. These rates are then used during the projection period to determine the annual number of migrants in each of the four flows that yield the expected total net-migration for each projection year.

Specific Assumptions and Decisions: Between the last postcensal year 2019 and 2024, the total number of migrants per age group per county are converged towards the average number of such migrants for the period 2010-2018. Starting in 2025, the gross migration flows by age are fixed to the age-specific ratios from the 2024-2025 period and held constant throughout the projection period causing net migration to vary between 100,000 and 110,000 during the projection period.

Several county-level adjustments were made for special cases or to reflect reviewer feedback. The following counties were modified:

In Butte County, an adjustment was made to handle the migration consequences of the Camp Fire in late 2018, which displaced a large number of residents from Butte County into neighboring counties. Rather than converge from 2019 levels, we set the model to continue from 2018 and incorporated some catch-up growth during 2020-2025 to implement our expectation of higher than average housing unit growth and in-migration during the recovery.

In Glenn and Contra Costa Counties, net migration was trended to 2025 without 2019. For Calaveras, Contra Costa, Inyo, San Diego, San Francisco, San Luis Obispo, and Solano Counties, it was felt that

both domestic in- and out-migration was too high and was adjusted downward by 2.5 percent. Similarly, only domestic out-migration was decreased for Kern and Los Angeles Counties (2.5 percent), and Kings, Merced, and Mono Counties (7.5 percent). On the other hand, we increased domestic in-migration by 5 percent for Inyo, Kings, Lassen, Merced, San Benito, and Yuba Counties.

5. Special Populations

Special treatment is required for the population living in group quarters (GQ), including prisons, dormitories, military barracks, residential hospitals or nursing homes, monasteries, and other group accommodations. There were 819,816 persons enumerated in GQ in the 2010 Census. These populations are not subject to the same mortality, fertility, or migration hazards as those living in households. For each year during 2010-2019, the size of the GQ population is controlled to the DOF-estimated total GQ population, and the 2010 Census SF2 file is used to establish the age, race/ethnicity, and sex distribution. After 2019, the total GQ population is held constant.

University students living in households rather than dorms exhibit similar population dynamics to the dorm population rather than the household population. These populations maintain a stable age structure, as outgoing students are generally replaced by incoming students. They are treated like special population records for the population projection; e.g., to simulate the dynamic of replenishment through graduation and new enrollment, they are not aged forward.

External Review

The preliminary projections are offered for review to the four large regional planning agencies in California. Their feedback is evaluated by DOF and adjustments are made for specific counties before final production with the latest available data. The preliminary projections were produced before the release of the July 2019 estimates which had a significant downward revision in the migration profile.

An internal review was conducted within the Department of Finance to ensure consistency with economic and other forecast assumptions.

Published Data

Summarized data are published as P-1 series (statewide) and P-2 series (county) projections. The complete public use dataset (P-3) contains counts of the population for each California county for July 1 of every year from 2010 through 2060, by individual year of age (0-100+), sex, and seven race/ethnicity groups. See the DOF website at dof.ca.gov/Forecasting/Demographics/Projections/

Authority

The population projections were prepared under the mandate of the California Government Code (Cal. Gov't Code § 13073, 13073.5). It is state policy that all state plans make use of the "*. . . population projections and demographic data that is provided by the State's Demographic Research Unit*" (Cal. State Admin. Manual § 1100).

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Research design, data collection, analysis and interpretation, technical report and dataset by Ethan Sharygin and Andrés Gallardo. Reviewers: Walter Schwarm and Eddie Hunsinger.

Suggested citation

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