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State of Georgia Population Projections October 2019

Carl Vinson Institute of Government
Applied Demography Program

A Report Prepared for the Governor's Office of Planning and Budget

State of Georgia

Population Projections

"October 2019 Series"

Carl Vinson Institute of Government Applied Demography Program

Contents

1 Executive Summary

The State of Georgia and the Office of its Governor, in order to effectively plan and deliver services to both present and future populations, maintains an active demography program. This program informs policy and planning, helps direct funding allocation, and supports empirical policy analysis. Local governments and other stakeholders rely on the state's program to manage the economic, social, political, and environmental consequences of population growth and demographic change. Private sector actors also utilize demographic data in wide-ranging ways, including to guide significant investment decisions.

State-level demography programs vary considerably in the US, but they all generally involve the preparation of population estimates or projections or both at various geographic levels, and the calculation of such population indicators as fertility rates, life expectancy, and migration patterns. In the State of Georgia, the Governor's Office of Planning and Budget is charged with the responsibility of preparing, maintaining, and furnishing official demographic data for the state (O.C.G.A. § 45-12-171). This current document describes the most recent iteration of state population projections, completed in October of 2019, to provide a foundation for assessing future planning and budgeting.

This round of projections is the second set for which input rates and trends were derived from post-recession data, enabling analysts to more reliably assess which demographic processes are exhibiting new trends, and which were merely temporal disruptions from the magnitude of economic dislocation during the 2007-2009 Great Recession. The previous round of projections relied upon data from the years 2013 to 2017; and those have been updated with information on births, deaths, and population counts from the period 2014 to 2018.

The projections show five primary emerging trends. First, Georgia is expected to see fewer births than necessary to replenish the population going forward, generally referred to in demography as sub-replacement fertility rates. Second, the state faces a rapidly aging Baby Boomer generation and higher levels of mortality, which, taken together with reduced births, translates to a lower pace of natural increase. Third, Georgia will consequently need to rely on migration to the state, primarily domestic but including foreign, to fuel positive population growth. Fourth, Georgia is likely to see continuing racial and ethnic diversification, due in part to higher fertility rates among some minority groups, and partly stemming from the aforementioned primacy of migration as a component of growth. Finally, the state is projected to see a continuation of the long-standing trend toward rural depopulation and urban expansion.

As Georgia continues to grow, the state will experience shifts toward racial and ethnic diversification across all age groups and throughout every county. The diversification will occur against the backdrop of a burgeoning senior population of non-Hispanic whites. The boom in youthful nontraditional minority populations comes as a timely remedy to the aging native population, renewing the workforce and staving off the prospect of population decline. This report presents a detailed methodology of the process by which the October 2019 series of Georgia population projections were made.

2 Methodology

Faculty and staff at the University of Georgia's Carl Vinson Institute of Government Applied Demography Program produced projections for the resident population for Georgia and each of its 159 counties for the Georgia Governor's Office of Planning and Budget (OPB).

The Institute of Government implemented a hybrid version of its stochastic model. Stochastic models incorporate the inherent uncertainty of demographic processes while at the same time provide mechanisms to apply knowledge of the future direction of underlying trends in fertility, mortality, and migration. Our base model, which produced the previous round of projections, incorporated county-level net migration rates averaged over five years using a residual method to calculate the population of migrants. The estimates were blended with 2010 Census inflows and outflows. We then modified the base model to build in the ability to draw on IRS migration data to develop rates, which were blended at the metropolitan, rural-urban continuum codification (RUCC), regional, and county level. We found that this second approach, which differed from the base model only in terms of the migration component, produced more robust and realistic migration scenarios. However, in many counties with highly unstable migration rates, we found that our base approach to migration produced the results with greater face validity. We thus produced a blended projection that selects the best results from each model. As had been done previously, we ran our models through thousands of iterations, surviving the population forward in five-year intervals, governed by observed statistical parameters as well as informed assumptions. The models allow for the range and pattern of those parameters to vary within bounds established by those assumptions. The median scenario chosen by our model is taken to be the projection of the population. To help elucidate the inherent error in statistical forecasting, we identify a 10% to 90% confidence interval containing 80% of our simulations. Those confidence ranges are available in the datafiles produced by the Institute's projection model.

These projections, like all projections, involve the use of certain assumptions about future events that may or may not occur. Users of these projections should be aware that although the projections have been prepared using established and validated methodologies, input from subject matter experts, and with extensive attempts to account for existing demographic patterns, they may not accurately project the future population of the State of Georgia or of particular counties in the state. These projections should be used only with full awareness of inherent limitations of population projections in general and with specific familiarity with the procedures and assumptions delineated in this methodology statement.

The current projections consist of future count estimates of the resident population of Georgia and of all counties in Georgia for single years through 2068. The population is detailed by 18 five-year age cohorts, 0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, and 85 and older, for males and females, in each of four race/ethnic groups: non-Hispanic whites, non-Hispanic blacks, Hispanics of all races, and non-Hispanic Other. The latter category groups individuals who self-identify as Asian, American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, or multiracial. This methodology statement details the steps involved in preparing the projections, including the bases and the underlying assumptions.

2.1 Cohort Component

The Institute of Government employed a cohort-component technique to project forward the Georgia population. The cohort-component method is among the most widely used techniques in the United States for producing population estimates and projections. Rather than modeling population size, each component of population change — fertility, mortality, and migration — is modeled separately. Current trends in birth rates, death rates, and net migration rates are calculated and applied to a base population via the demographic balancing equation:

$$P_{t_2} = P_{t_1} + B_{t_1-t_2} + D_{t_1-t_2} + M_{t_1-t_2},$$

where:

P_{t_2} = the population at some future date $t_1 - t_2$ years hence,

P_{t_1} = the population at the base year t_1,

$B_{t_1-t_2}$ = the number of births that occur during the interval $t_1 - t_2$,

$D_{t_1-t_2}$ = the number of deaths that occur during the interval $t_1 - t_2$,

$M_{t_1-t_2}$ = the net of migration that takes place during the interval $t_1 - t_2$.

When several cohorts are used, P_{t_2} may be seen as:

$$P_{t_2} = \sum_{i=1}^{n} P_{c_i t_2},$$

where:

P_{t_2} is as in the equation above,

$P_{c_i t_2}$ = population of a given cohort at time t_2,

$P_{c_i t_2} = P_{c_i t_1 - t_2} + B_{c_i t_1 - t_2} - D_{c_i t_1 - t_2} + M_{c_i t_1 - t_2}$,

where all terms are as noted above but are specific to given cohorts c_i.

2.2 Resident Population

The resident population includes all persons who dwell primarily in Georgia. The population is composed of persons for whom Georgia is their "usual place of residence." These include persons in a variety of living quarters such as single-family housing units, multi-unit structures such as duplexes and apartment buildings, nursing homes, military barracks, college residence halls, and correctional facilities. Seasonal and temporary residents are not included.

The following summary provides a detailed description of the stages of development of the projections and the methodologies employed.

2.3 Projection Methodology

To develop an appropriate adaptation of the cohort component approach, four major steps were completed:

1. A baseline set of cohorts for the projection area or areas of interest for the baseline time period was selected.
2. Appropriate baseline migration, survival, and fertility measures for each cohort for the baseline time period were determined.
3. A method for projecting trends in fertility, survival, and migration rates over the projection period was determined.
4. A computational procedure was selected for applying the rates to the baseline cohorts to project the population for the period of interest.

2.3.1 Baseline Cohorts

Population data for the launch year of 2018 come from the U.S. Census Bureau Population and Housing Estimates program. Statistics on births and deaths are drawn from years 2014 to 2018 of the Georgia Public Health vital records, which provides demographic detail on race, age, and sex at the county level for household residents each year.

Special populations, also known as group quarters, such as those living in college dormitories, military barracks, or prisons, were based on the recorded count in the 2010 Decennial Census, survived forward to the launch year through an age-sex-race/ethnicity-based ratio technique, assuming that all age-sex-race/ethnic groups maintained the same proportion in the group quarters and were only affected by overall population growth.

The baseline cohorts are composed of four mutually exclusive groups derived from Census race and ethnic classifications: non-Hispanic white alone, non-Hispanic black or African American alone, Hispanics of any race, and persons in all other non-Hispanic race groups are categorized as non-Hispanic Other.

2.3.2 Cohort Component Rates

Fertility

Baseline age-race/ethnicity-specific fertility rates were computed for each county in Georgia and then used to compile total fertility rates (TFR) for each county race/ethnic group. The numerators for the rates were the average birth counts recorded by the Georgia Department of Public Health (DPH) in the 2014-2018 period, whereas the denominators equate to the female household population in 2014 to 2018 in each age group from 10 to 45. Because some populations were sparse for age-sex-race/ethnicity categories in certain counties, we found rates to be unstable and we constrained them using interquartile goalposts. Low TFR rates were allowed to trend toward the replacement rate TFR of 2.2 after a period of time.

Mortality

Baseline age-sex-race/ethnicity-specific mortality rates were computed for every county in Georgia. The numerators for the rates were the deaths by age-sex-race/ethnic group in each county, as recorded by DPH. The denominator equated to the total baseline population described above. From these mortality rates, we constructed life tables with standard survival rates and life expectancy. In our projection model, we adjusted future life expectancy targets higher, in line with those projected by the US Census Bureau, gradually increasing projection survival rates above the baseline computed rates. The Institute of Government model utilizes a dynamic approach to mortality, trending life expectancy higher for all race/ethnic groups and sexes, and assuming that they will approximate convergence across the projection horizon.

Migration

In the base model, net migration rates were computed using a residual methodology for the household population for each sex-age-race/ethnic group in each county. In our extended migration approach, we used IRS county-to-county migration data to estimate a five-year average along with a standard deviation for the inflow and outflow rates for each county. We then used the residual method using Georgia Public Health data to create an estimated population change measure for migration for age-race-sex categories for each county. We then proportionally allocated this age-race-sex structure against the inflow and outflow rates. We simulated different migration scenarios by jittering previous migration rates with an normally distributed error centered at zero and using the aforementioned standard deviation. Based on historical patterns, we added more variance for great potential inflows and lesser outflows for the counties associated with the Rural/Urban Continuum Codes $(1-3)$. These codes corresponded mostly to the metro Atlanta area and the other metropolitan areas in the state. We additionally adjusted counties in Regional Commissions when necessary. For example, to account for migration of older populations that do not necessarily conform to economic migration, we accounted for higher migrant inflow in the Georgia Mountain region. These numbers should not be perceived as base rates, but increased bounds for the randomly sampled error that constitutes the stochastic projection.

Urban-Rural

For all of our rates, we separated rural and urban counties using the US Department of Agriculture's Economic Research Service's 2013 Rural-Urban Continuum Codes (RUCC). These codes distinguish among metropolitan counties by the population size of their metro area, and non-metropolitan counties by degree of urbanization and adjacency to a metro area. Counties with rural-urban continuum codes of 1 to 3 receive a metro designation; those with codes 4 to 9 are considered non-metro. In the migration version of the hybrid model, rates were tied to their individual RUCC classification, since, for example, a non-metro county in a rural area would be expected to have a different migration pattern than a non-metro county adjacent to a metro county with interconnected economic and labor ties.

2.4 Projection Method

Our projection method relies on a bottom-up approach: County populations were projected and summed to produce a state projection. That projection was then cross-validated with other sources, including independent projections, neighboring state projections, and simple ARIMA methods.

The cohort-component rates described above were applied to a survival matrix in five-year intervals. In each progression, the group quarters population was removed from the resident population to produce a household population, which was survived forward using cohort-component rates, with migration added to the total. The group quarters population was survived separately based on a ratio method, and added back into the population at the end of each step. Because this methodology was insufficient to accommodate the migration patterns of college students, we applied the college fix developed by the US Census Bureau for several counties with large university student populations, removing a fraction of the enrolled population from the household population [4]. This entire process was repeated every five years from 2018 to 2068. This entire model was iterated thousands of times to produce the most probable median projection scenario, as well as to identify the 10% to 90% confidence interval.

2.5 Computation Procedure

The Institute of Government model was developed by demographers and data scientists in the Applied Demography Program. The Institute research team created the model in the R statistical programming language version 3.6.0 ("Action of the Toes") and ran it on R-Studio software version 1.2.1335. Five-year progressive projections were transformed to single-year estimates using linear interpolation after testing determined this would be the most conservative and sound approach.

2.6 Limitations

Although the cohort-component model has been exhaustively used and tested throughout the years, it is not infallible. In empirical studies, researchers have noted that the range of error grows substantially the further out in time the projection is. One prominent issue is that smaller-level geographies are inherently difficult to assess in terms of demographic rates, particularly when populations are subdivided by age, sex, and race/ethnic categories. This effect is magnified in areas with sparse populations. Georgia, hence, presents a special challenge due to its large number of relatively small counties, many of which in turn comprise small populations. Generating accurate birth and death rates may be compromised by even a small number of births or deaths that are recorded with error or in a separate geography due to the cross-county mobility of residents. Migration flows are notoriously difficult to capture at the county level, and this problem is also exacerbated in counties with sparser populations. A second issue is that the selection of 2014-2018 population counts are determined by Census Bureau estimates. Despite a reasonable track record at the state level, in less populous rural counties the estimation program has tended to record larger errors. Finally, although relying upon five-year trends to generate 50-year projections is not uncommon, it is possible that certain temporal population tendencies will be incorporated into the overall model that in fact were only a "blip" in terms of longer-range trends. To address the shortcomings inherent in any population projections, as well as the issues specific to Georgia's unusual geographical structure, painstaking effort was made to evaluate the results in light of expert knowledge and, where possible, to modify the model assumptions to mitigate unusual patterns.

3 Bibliography

References

[1] Vespa, Jonathan, David M. Armstrong, and Lauren Medina, "Demographic Turning Points for the United States: Population Projections for 2020 to 2060," Current Population Reports, P25-1144, US Census Bureau, Washington, DC, 2018.

[2] Office of Health Indicators for Planning (OHIP), Retrieved from: https://oasis.state.ga.us/oasis/, Georgia Department of Public Health, 2019.

[3] Yowell, Tiffany and Jason Devine, "Evaluating Current and Alternative Methods to Produce 2010 County Population Estimates," Population Division US Census Bureau Working Paper No. 100 US Census Bureau, Washington, DC, 2019.

[4] Ortman, Jennifer M., Larry D. Sink, Heather King, "The 'College Fix': Overcoming Issues in the Age Distribution of Population in College Counties." Population Division, U.S. Census Bureau. October 2014.