Methods for Minnesota Population Projections: 2024-2075

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This document outlines the methodology employed to generate comprehensive population projections for Minnesota. These projections estimate future population distributions across various geographic levels and demographic dimensions within the state, including age, sex, and race. The process ensures that the projections are accurate, reliable, and internally consistent.

Data Sources

The population projections utilize data from the U.S. Census Bureau, specifically:

- National Population Projections: These projections offer a baseline for understanding national demographic trends and their potential impact on Minnesota.
- Annual Population Estimates: Utilizing vintage 2019 data for the years 2010 through 2019 and vintage 2022 data for 2020 through 2022, these estimates provide the most recent insights into population changes and are critical for accurately determining base-year populations and recent trends.

Methodological Framework

This section outlines the structured approach taken to develop population projections for Minnesota through a series of detailed and systematic steps. The methodology employs a top-down strategy, transitioning from broad national demographic trends to specific geographic and demographic details within the state. Central to the analysis is the shift-share method, a technique utilized in regional economics to analyze and project changes in economic activity and population distribution. This method allows for allocating broader national changes among regional units based on their historical shares and specific characteristics. For readers unfamiliar with any of the terms or methodologies mentioned, a more comprehensive glossary of key terms is available at the end of this document for easy reference.

Each step in the methodology ensures that the population projections accurately reflect Minnesota's unique demographic and geographic landscape. The dataset navigates from national-level analyses to more granular considerations of Minnesota's Economic Development Regions (EDRs), counties, and key demographic segments, including age, sex, and race.

The subsequent sections detail the sequential steps in the projection process, from initial data sources and national-level analysis to the nuanced considerations of Minnesota's diverse communities.

1. The projection starts with the shift-share method to calculate:
    a. The Midwest region's share of the national population, which is based on the U.S. Census Bureau's national population projections.
    b. Division 3's and 4's share of the Midwest region's population.
    c. Minnesota's share of Division 4's population.
2. Using the state-level projection as a base, the total populations of the Greater Minnesota and Twin Cities regions are estimated with the shift-share method, referencing recent trends in the Census Bureau's annual population estimates.
3. The process extends to project the populations of the 13 EDRs within Minnesota, employing the shift-share method to reflect regional demographic and economic characteristics.
4. The methodology then narrows down to estimate the total populations of Minnesota's 87 counties, again using the shift-share method to capture county-specific demographic trends.
5. Race projections (i.e., White, Black, American Indian, Asian, Native Hawaiian or Pacific Islander, Multiracial, and Hispanic categories) are developed for all 13 EDRs and select counties (i.e., Beltrami, St. Louis, Nobles, Olmsted, Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington Counties). This step involves the application of the shift-share method to project the racial composition, informed by historical trends and current demographic data.
6. County total populations estimate sex ratios for Minnesota's 87 counties, utilizing the shift-share method based on demographic patterns.
7. The process further refines demographic projections by estimating age distribution in 5-year cohorts for all counties, using projected sex ratios, cohort change ratios, and child-woman ratios.

The final step in the process is known as iterative proportional fitting or raking. Raking is a statistical technique employed to adjust the weights of individual records in a dataset so that the marginal totals match specified control totals. In the context of these population projections, this process ensures that the projected figures for smaller geographic areas (e.g., counties) align with projections for larger areas (e.g., the entire state) and that demographic characteristics within each area are proportionally accurate.

Raking Execution Steps:

1. Begin with initial population projections for each geography and demographic group. These projections are based on the analyses detailed in the earlier steps.
2. Control totals are identified for each level of geography and demographic characteristic. These totals are derived from higher-level projections and known demographic

distributions. For example, the total population of Minnesota is a control for adjusting county-level populations.

3. The core of the raking process involves iteratively adjusting the projections so that the sums of the projections across different dimensions (e.g., age, sex, race) match the control totals. The process involves adjusting one dimension at a time, cycling through all dimensions until the changes between iterations fall below a predefined threshold, indicating convergence.
    a. For a given dimension (e.g., age group within a county), all entries are proportionally scaled so that their sum matches the control total for that dimension.
    b. After adjusting one dimension, the process moves to the next, updating each until the entire dataset's margins align with the control totals. Convergence is assessed using the difference in totals between iterations.
4. The raking process is applied to adjust geographic populations and ensure that each geography's demographic characteristics accurately reflect the control totals derived from higher-level projections and census data. This provides internal consistency across geographic and demographic layers.
5. Once the iterative process converges, the resulting projections are considered finalized. These projections now accurately reflect the detailed characteristics of smaller geographic areas and broader patterns observed at higher levels of aggregation.

Potential Limitations and Assumptions

The population projections methodology is built upon several assumptions and is subject to potential limitations that users should consider when interpreting the projections:

Assumptions About Future Trends: The projections rely heavily on assumptions about future demographic behaviors (e.g., fertility, mortality, migration) based on historical trends. Significant deviations from these trends could affect the accuracy of the projections.

Static Methodological Assumptions: The shift-share method and other analytical techniques assume that past trends and relationships will continue. Economic conditions, policy environments, or unexpected demographic shifts could alter these relationships.

Data Limitations: The quality of the projections is contingent upon the accuracy of the data sources used, including the Census Bureau's estimates and projections. Any inaccuracies or biases in these data sources could propagate to the final projections.

Geographic and Demographic Specificity: While the top-down approach and raking process ensure consistency across different levels of data aggregation, they may not fully capture local dynamics or changes that could affect specific geographic areas or demographic groups.

Raking Process Limitations: While effectively aligning projections with control totals, the raking process assumes that the adjustments can be made proportionally across all categories and regions without losing the underlying detail or accuracy.

Glossary of Key Terms

Annual Population Estimates: The U.S. Census Bureau provides official estimates detailing specific years' population size and composition. "Vintage" refers to the year the estimates are released, with Vintage 2019 covering years 2010 through 2019 and Vintage 2022 for 2020 through 2022.

Cohort Change Ratios: A demographic measure used to estimate the change in population size for specific age cohorts over time based on historical data and trends.

Economic Development Regions (EDRs): Geographic areas within Minnesota identified for regional economic planning and development. There are 13 EDRs, each with distinct economic profiles and demographics.

National Population Projections: Future estimates of population size and composition generated by the U.S. Census Bureau, based on current demographic trends such as birth, death rates, and migration patterns.

Raking Process: A statistical method used to adjust data from smaller geographic or demographic segments (child geographies) to ensure they sum up accurately to totals for larger areas (parent geographies). This process is vital for maintaining internal consistency across projections.

Shift-Share Method: A technique used in regional economics to analyze changes in economic activity or population levels by attributing differences to national trends, industry mix, and regional competitive effects. In the context of population projections, it allocates broader national demographic changes among regional units based on their historical shares and specific characteristics.

Top-Down: A methodological strategy that starts with broad, aggregate data or projections at a national or large regional level and progressively disaggregates this information to make projections for smaller, more specific geographic areas or demographic groups.