Vintage 2013 State and County Household Projection Methodology

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Introduction

The development of household projections at the county level relies on the Demographic Services Center's series of county age-sex population projections for 2010 - 2040. The values in the population series serve as anchors for the age-specific categories in the household series. Because of the way that the Census Bureau compiles data in its Summary File tables related to age of householder, the five-year age-sex population projections need to be collapsed into broader age groups and/or across sexes, but it is possible to preserve some age detail in the translation from population to household projections.

Unlike the state population projections, the state household projections are not derived initially in a separate procedure. They are merely the sum of all 72 counties' projections.

The current Census Bureau definition of a household is assumed to hold into the future: all persons who occupy a housing unit—a room or group of rooms that have direct access from outside the building or through a common hall—as separate living quarters. For enumeration purposes, the Bureau defines one person as the householder; thus, the count of householders equals the count of households.

Persons living in nursing homes, correctional institutions, mental care facilities, college residence halls, halfway houses and the like constitute group quarters population (shortened to GQ population below). Persons living in households constitute the household population. Thus, the total population minus the household population equals persons living in group quarters. The projections technique does not actively calculate projected GQ population; in other words, this population subset is a residual.

In addition, the Census Bureau's guidance sets a minimum threshold for householders at 15 years of age. These household projections adhere to this reasonable assumption that no households are headed by anyone under age 15.

Base & Projected County Household Rates

Two base rates are necessary for the development of the county household projections: the household population as a share of total population, by age (called the S rate in the formulas that follow); and householders as a share of household population, by age (called the householder rate, or HR for short).

Data for this vintage's S rates were obtained from Census 2010 Summary File 1, Tables P012 (total population by 5-year age groups and sex) and PCT013 (household population by five-year age groups and sex). The sexes were combined, but at this point the five-year age intervals could be maintained because the projected county populations are also in five-year age categories:

$$S_{ac,2010} = HHP_{ac,2010} \div P_{ac,2010}$$

Where $S_{ac,2010}$ is the household population share rate for age group *a* in county *c* at 2010,
$HHP_{ac,2010}$ is household population in age group *a* in county *c* at 2010,
$P_{ac,2010}$ is the population in age group *a* in county *c* at 2010.[1]

These S rates are then multiplied by the county population projections, 2015 through 2040 (sexes combined), to generate the projected household population by 5-year age groups:

$$HHP_{ac,y} = P_{ac,y} \times S_{ac,2010}$$

Where $HHP_{ac,y}$ is the household population in age group *a* in county *c* at projection year *y*,
$P_{ac,y}$ is the population in age group *a* in county *c* at projection year *y.*

An underlying assumption is that the S rates will remain constant from the base year through the 30-year projections period. Two observations underlie this use of a single point in time, rather than calculating an average or a trend over several censuses.

First, the household population as a proportion of the total population is dependent on its inverse (1 – *S*), the proportion in group quarters population. In recent decades, Wisconsin embarked on constructing new state correctional institutions, or expanded existing ones markedly; in some cases, new facilities were sited in relatively low-population counties. These location choices impacted the *S* rates substantially from one census to the next. However, the era of extensive prison expansion subsided in the early 2000s, and there are no current plans to build or expand existing ones. Thus, group quarters as a share of total population may remain relatively constant for a while into the future.

Second, there is no way to anticipate where sizeable changes in group quarters facilities may occur (either openings and expansions or closures and contractions) over the next three decades. The other two large group quarters categories, college residence halls and nursing homes, may increase or decrease, but the change tends to be gradual, and the localized effect is minimal.

At this point, to match the age categories available for householders' data, the projected household population values were collapsed to a 15-year group of ages 0-14, 10-year intervals from 15-24 through 75-84, and the ultimate group of age 85 and older. The broader age categories are symbolized as *a'* in the formulas that follow.

The basic householder rate formula is:

$$HR_{a'c,b} = HH_{a'c,b} \div HHP_{a'c,b}$$

Where $HR_{a'c,b}$ is the householder rate for age group *a'* (collapsed into broader categories) in county *c* at base year *b*,
$HH_{a'c,b}$ is the number of householders in broad age group *a'* in county *c* at base year *b*,
$HHP_{a'c,b}$ is the number of persons living in households for broad age group *a'* in county *c* at base year *b.*

[1] It is possible to calculate separate S rates by 5-year group *and* sex, and apply these rates to the population projections. This separation was tested against the combined method; it was found to have virtually no effect on the projections of households, household population or GQ population, so the combined method was retained.

To establish the householder rates to be used as base figures and for projections, several statistical tests were conducted to determine the best share method to apply: constant-share (maintaining Census 2010 proportions into future), average-share (of Census 2000 and 2010 proportions), or shift-share (trending change in proportions from Census 2000 to 2010).[2] The testing utilized Census 1990 and 2000 rates and compared the results of the three share techniques to the actual Census 2010 rates. Overall, for all age groups, the average-share technique had the best predictive outcome. Thus, it was selected for this vintage of county household projections.[3]

With the householder rates finalized, the formula for calculating projected households by age of householder is:

$$HH_{a'c,y} = HR_{a'c,b} \times HHP_{a'c,y}$$

Where $HH_{a'c,y}$ is number of householders (equivalent to households) in age group *a'* in county *c* at projection year *y*.

Other Projected County Values

The completion of projected households and household population permits the calculation of projected average household size (or persons per household, abbreviated to PPH) at the county level. These county-level PPHs are employed in the minor civil division (MCD) household projections. The formula is:

$$PPH_{c,y} = \sum_{a'=1}^{n} HHP_{a'c,y} \div \sum_{a'=1}^{n} HH_{a'c,y}$$

Where $PPH_{c,y}$ is the persons per household in county *c* at projection year *y*.

It should be noted that, for the summation operators in the equation above, the household population consists of nine age brackets (starting at ages 0-14), while the householders are made up of only eight (starting at ages 15-24). However, since the householder rate for the household population ages 0-14 is established as 0 (because householders of this age are proscribed), the householders are 0.

Finally, the projected county group quarters population may be calculated by subtracting the aggregated household population from the total projected population. These values are needed as controls in the MCD projections. Formulaically:

$$GQP_{c,y} = P_{c,y} - \sum_{a'=1}^{n} HHP_{a'c,y}$$

Where $GQP_{c,y}$ is the group quarters population in county *c* at projection year *y*.

[2] The particular Census summary tables from which age-of-householder data were drawn were Summary File 1, Table P022 from Census 2010, and Summary File 2, Table PCT12 from Census 2000.
[3] The constant-share method was employed in the vintage 2003 and 2008 projections.