Vintage 2013 Minor Civil Division Projection Methodology: Some Salient Points

Prepared by:
David Egan-Robertson
UW-Madison Applied Population Laboratory
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INTRODUCTION

Demographic Services Center first released a set of MCD-level population projections in 1986.[1] Since then, the MCD projections have been prepared twice each decade. The methodology that Demographic Services employs to project the populations of Wisconsin's minor civil divisions was developed within the framework of some general guidelines based on the forecasting literature, both demographic and non-demographic. The main principles governing the projection methodology are summarized below.

1. Long-term population projections, particularly for small areas, require consideration of historical data series so that the past and projected time horizons are, at minimum, of approximately equal length.

2. A community's more recent experience in population change should have greater influence in the projection process than older experience. The assumption here is that while both more distant as well as recent data speaks to the future, the data from more recent periods speak with greater force. This approach has both strong intuitive appeal and empirical support.

3. Since county projections generally are produced using more developed methodologies than are available for MCD projections (in Wisconsin's case, the cohort-component method), the latter should be adjusted to incorporate the projected trends for the associated county. Exploiting a wider range of information, county projections are believed to give a population size of greater confidence than does the sum of the sub-area projections. Nevertheless, an MCD projection based on its own population trend does contain the elements of a "place effect," and should not be completely diluted. MCD projections containing both the "county effect" and the "place effect" should yield the best results.

4. Extrapolation models tend to presume a continuation of trends that, for practical purposes, may not be sustainable for long periods into the future. Rarely does a community grow (or decline) *ad infinitum.* In particular, the availability of land and local limitations on its use can impact a community's growth. Hence, rates of change that have been rapid may need to be tempered in projections mode.

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[1] MCD is the abbreviation for "minor civil division," also called "county subdivision" in Census Bureau products. Both terms refer to local units of government or areal parts of local governments that nest within county boundaries. In Wisconsin, 54 municipalities (cities and villages, collectively called incorporated places) straddle county boundaries, so they have two or more component MCDs. In this document, the terms "MCD" and "community" are used interchangeably, but refer to minor civil divisions.

5. The population of individual cities, villages, and towns may be affected not only by demographic components of change—births, deaths, and migration—but also by territorial changes that are often less amenable to extrapolation than purely demographic factors. Therefore, it is desirable to discount the effect on projections of past areal changes that transfer sizable populations from one community to another.
6. Local geophysical conditions, environmental concerns, current land use plans and zoning restrictions, taxation, and other policies influence business and residential location. These and similar factors that steer the course of local development can have a profound effect on future population change. However, they cannot be readily forecast.

In sum, these principles—which guide the MCD-level projections produced by Demographic Services—will lead to the production of *baseline* projections. At a localized level, the knowledge of constraints on population change may lead local planners to modify these projections before incorporating them into planning documents or facility construction proposals. Local data and knowledge that provide an objective basis for potential changes are likely to enhance the credibility of alternative projection series.

CALCULATION OF PROJECTED ANNUAL CHANGE

For this projections vintage, the initial data inputs consisted of the population counts from the 1990, 2000 and 2010 Censuses and Demographic Services' estimates for January 1, 2013. These enumerations and estimates were modified due to selected circumstances that impact communities' growth patterns:

1. Persons annexed to and from MCDs over each interval (that is, the intercensal 1990-2000 and 2000-2010 periods and 2010-2013), as reported to the Wisconsin Secretary of State's office and compiled by Demographic Services;
2. Substantial growth or decline of large group quarters populations;
3. Group quarters' mis-enumerations and misallocations;
4. Partial incorporations.

Applying the principle that the future population change of a community will resemble variation that is more recent than more distant, a weighted average annual population change (called G) was calculated for each MCD:

$$G = ((P_{E2013}-P'_{C1990})/(t_{E2013}-t_{C1990}) + ((P_{E2013}-P'_{C2000})/(t_{E2013}-t_{C2000}) +(P_{E2013}-P'_{C2010})/(t_{E2013}-t_{C2010}))\div 3$$

where: P_{E2013} is the final MCD estimate for 1/1/2013;
P'_{C1990}, P'_{C2000}, and P'_{C2010} are the adjusted Census values;
t_x are the calendar dates for the censuses and most recent estimate; the values produced are treated as quarter-years (that is, $t_{E2013}-t_{C1990}$ = 22.75 years, $t_{E2013}-t_{C2000}$ = 12.75 years, $t_{E2013}-t_{C2010}$ = 2.75 years).

These G values are numeric; they imply an average annual change in the number of residents. To obtain percentages, G is divided by the 2013 estimate. It should be noted here that the MCD projections differ from the state and county projections in that the most recent estimate is the

"point of departure" for the projections; at the state and county level, the point of departure is April 1, 2010.

In order to temper rates of change that may have been quite high or low across the base period, the mean and standard deviation of the annual percentage changes within each county were computed, and upper and lower bounds for annualized growth rates within county were set by the county's mean ± 1.5 standard deviations. These "pulled-in" rates were then multiplied by the 2013 estimate to again produce a modified average numeric change: a "modified G" or G'.

The two procedures described above—calculating a weighted annual value across an extended time frame and pulling in any outlying changes—help to smooth and minimize sharp increases or decreases. However, there is still a remote possibility that, for communities with a predicted negative G', a linear extrapolation of this change could lead to the MCD's population falling into negative territory at a future date. To prevent this anomaly, a trial 80-year projection—about three times our projection horizon of 27 years—for each MCD was calculated. If the decline indicated by G' was such that the projected MCD population after 80 years would fall below zero, G' was adjusted so that the MCD population size equaled zero at the 80-year point.[2]

UNCONTROLLED AND CONTROLLED PROJECTIONS

With the finished G' values in place, the initial computation of future population was a simple extrapolation. That is, starting from our 1/1/2013 point of departure, the formula to obtain the projection at 4/1/2015 was:[3]

$$P_{2015} = P_{2013} + 2.25 \times G'$$

Then $P_{2020} = P_{2015} + 5 \times G'$, $P_{2025} = P_{2020} + 5 \times G'$, and so forth to 2040.

At this point, the sum of the MCD projections within each county typically does not match the county projections that had been prepared using the cohort-component method. To bring the county and MCD projections into alignment, the MCD projections are proportionally adjusted within each county.

REFERENCES

Voss, Paul R. and Balkrishna D. Kale, 1985. "Refinements to Small Area Population Models: Results of a Test Based on 128 Wisconsin Communities." Paper presented at the annual meeting of the Population Association of America, Boston, March 28-30, 1985.

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[2] In practical terms, this adjusted modified G process affected only eight of the state's 1,911 MCDs in this vintage.
[3] Because the Censuses have a reference date of April 1, the projections—at state, county and MCD levels—are also referenced to April 1 at five-year intervals.