# Cohort-Based Evaluation of the Vintage 2010 Population Estimates: The Role of International Migration: 2000 to 2010

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## Introduction

The U.S. Census Bureau is mandated by United States Code Title 13, Section 181 to annually produce and publish total population estimates for states, counties, and local government units with populations of 50,000 or more. The population estimates are used in federal funding allocations, as survey controls (e.g., American Community Survey, Current Population Survey, Survey of Income and Program Participation etc.), as denominators for rates (birth rates, death rates etc.), for program planning, and as indicators of demographic change.

The population estimates measure change between decennial censuses. The national, state, and county estimates update counts from the most recent Census with post-census estimates of births, deaths, and migration to produce estimates of the population after Census day.[1] Given the widespread use and importance of the population estimates, comprehensive and regular evaluations of the estimates and the methods use to produce them are essential. Every year, the Population Estimates Program at the Census Bureau commits substantial resources to evaluate and refine its methods, data, and production processes. In addition to the standard evaluations, the decennial census provides a benchmark for evaluating the previous decade's population estimates. We plan to evaluate the national-level Vintage 2010 Population Estimates by comparing the estimated population change from 2000-2010 to the enumerated population change between the 2000 and 2010 Census counts. [2] We will focus on comparing change in age cohorts over the decade implied by the 2000 and 2010 Census to the estimated change due to births, deaths, and net international migration.

[1] Census day is on April 1 of the census year.
[2] The Census Bureau refers to its population estimates series as vintages. Each vintage begins with the latest decennial census and the year of the vintage refers to the terminal reference date in the series. For instance, Vintage 2010 begins with Census 2000 and provides population estimates for every year through July 1, 2010.

**Methods**

The national, state, and county population estimates are produced using the cohort-component method where

$$2010\ Population = 2000\ Population\ Base + Births - Deaths + Migration \quad (1)$$

Census 2000 was the base for the estimates up until Census 2010 counts were available. The Census 2000 base (2000 Population Base) was adjusted throughout the decade to account for successful challenges to the Census 2000 counts through the Count Question Resolution (CQR) program and changes in geographic boundaries.[3] We measured change from the 2000 Population Base using administrative records on births and deaths from the National Center for Health Statistics (NCHS). International migration was estimated using data from the American Community Survey (ACS), Puerto Rico Community Survey (PRCS), Census 2000, and censuses and population registers from other countries. Information on international movement of the armed forces population was obtained from the Defense Manpower Data Center (DMDC).

In this analysis, we will focus on population change from 2000 to 2010 at the national level that may be attributed to international migration. The Census Bureau produces net international migration estimates annually using the following subcomponents:

a) Net international migration of the foreign-born population,
b) Net international migration of the native-born population,

[3] Changes in geographic boundaries are attributed to legal boundary changes that occurred after Census 2000.

c) Net movement between the United States and Puerto Rico, and

d) Net international movement of the armed forces population.

Our goal is to evaluate the accuracy of our Vintage 2010 estimates of international migration. Evaluation of the components of change is challenging because there is no way to collect a comparable "count" of international migrants to use as a benchmark for comparison purposes. Instead, we plan to develop a proxy for international migration using a residual method and data from Census 2000, Census 2010, and estimates of births and deaths. The research will build on prior evaluations of our Vintage 2010 population estimates (Devine 2012, Velkoff, Devine, and Jones-Puthoff 2012, Devine and Wengert 2013, Yowell and Devine 2013).

We will focus on the population aged 10 and older on April 1, 2010 (Census day). To produce the Census residual estimate, we start with the population for a cohort in Census 2000 and age it forward by subtracting deaths which creates an expected 2010 population assuming zero net international migration. We then subtract this aged population from the Census 2010 value to get total change in the cohort that may be attributed to international migration.[4]

$$\textit{Total Change} = \textit{Aged Census 2000 Population} - \textit{Census 2010 Population} \quad (2)$$

Substituting this value in the balancing equation, we get

$$\textit{Total Change} = \textit{Migration} - \textit{Deaths} \quad (3)$$

[4] Differential coverage of the population in Census 2000 and Census 2010 would also have an impact on the residual estimate.

By adding deaths to the observed change we see that

$$Migration = Total\ Change + Deaths \quad (4)$$

Equation (4) is somewhat of a simplification, as it does not consider deaths that have occurred among international migrants. Since deaths play a relatively small role in the ages with the highest rates of international migration, this should have little effect on the overall results.

We plan to compare the residual estimate of international migration to our Vintage 2010 "alternative" estimates, which exclude changes in population estimates due to challenges by local governments and special censuses conducted throughout the decade. We will focus on differences by age, sex, race, and Hispanic origin.

**Summary**

In summary, this poster will compare our Vintage 2010 estimates of international migration with those derived from a residual method of calculating population change from Census 2000 to Census 2010. We will focus on particular age, sex, race, and Hispanic origin groups that make up a relatively large proportion of the population of international migrants. Specifically, we will examine the accuracy of our estimates of international migration for Hispanics as a group, Hispanics by sex, non-Hispanic Asians, and by select age groups.

Although the Census Bureau's Vintage 2010 population estimates have been shown to be very accurate at the national level (Yowell and Devine 2013), international migration is a difficult

component to estimate and the Census Bureau is continually researching method refinements. Our evaluation will help to inform academic and policy discussions on international migration and the results will be used to improve our estimates of the population and its demographic characteristics in the coming decade.

**References**

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