



Three Million Utahns

Technical Memorandum

To: Phil Dean, Governor's Office of Management and Budget
From: Pamela S. Perlich, Kem C. Gardner Policy Institute
Date: September 30, 2015

This technical memorandum conveys our analysis of when the methodology of the U.S. Census Bureau Population Estimates Program (Census) will reasonably infer that Utah reaches three million people. The memorandum also includes a response to your request that we consider a scenario in which the July 1, 2015 Utah population estimate reaches 2.99 million.

SUMMARY

We conclude Census population estimates will suggest Utah reaches 3.0 million residents around October 18, 2015. If Census surprises us with low estimates of every one of the components of change, it could be delayed until January 4, 2016. If they have high range estimates for the components of change and estimate the Utah population for July 1, 2015 to be 2.99 million, then the date will be advanced to August 20, 2015.

We generated this range of plausible dates for Census estimates reaching a population of 3 million in several steps. First, we calculated a range for their likely estimates of natural increase by considering the different numbers of births and deaths reported by the federal and state vital statistics offices post-census. Next, we calculated a range of likely net migration by fitting a linear regression line to post-censal trends, extrapolating to 2016, and generating a 90% confidence interval of likely net migration. Third, we used the resulting ranges of natural increase and net migration and then calculated the respective gaps to 3 million implied by the high, low, and middle estimates. We calculated the percent annual population increase implied by those estimates. Finally, we multiplied those percentage estimates by 365 days to generate a range (and midpoint) of the expected number of days into the fiscal year beginning July 1, 2015 (FY 2016) for reaching the 3 million mark.

ANALYSIS

Natural Increase

The July 1, 2014 Census Utah population estimate of 2,942,902 falls short of 3 million by 57,098. Our expectation of the timing until they estimate 3 million Utah residents is guided by their recent estimation practices and patterns. Since the April 1, 2010 enumeration, Census generated annual postcensal population estimates for Utah for each subsequent July 1. Each new vintage is a revision of the previous postcensal series. In the 2014 vintage series (for each July 1 from 2010 through 2014), these estimates have averaged annual population increases of 42,139. The natural

increase component (annual births minus annual deaths) accounts for 86 percent of this increase (averaging 36,111 annually). The balance is net migration. The international component of net migration has consistently been positive (averaging 5,217 annually) and trending upward. In contrast, the domestic net migration estimate has been erratic, ranging from net out migration of 1,235 for FY 2014 to a positive net in-migration of 5,530 in FY 2013. The residual also lacks a consistent pattern. These data are shown in Table 1 below.

Table 1
Population Estimates Produced by the U.S. Census Bureau – 2014 Vintage

	Population	Annual Change	Births	Deaths	Natural Increase	International Migration	Domestic Migration	Net Migration	Residual
2010	2,774,346								
2011	2,815,324	40,978	51,922	15,010	36,912	4,887	-919	3,968	98
2012	2,855,194	39,870	50,446	15,470	34,976	5,077	-87	4,990	-96
2013	2,902,787	47,593	51,806	15,390	36,416	5,438	5,530	10,968	209
2014	2,942,902	40,115	51,447	15,306	36,141	5,465	-1,235	4,230	-256
Average		42,139	51,405	15,294	36,111	5,217	822	6,039	-11

Note: All estimates are July 1. Components are for fiscal years.

Census is currently working on the July 1, 2015 estimates to be released in December 2015. Because their national sources of vital records data are incomplete, they rely on local vital records provided by our Utah Department of Health (UDOH) in this work. They utilize various data sources and analytical techniques to model data and generate the estimates. We compared the Utah Department of Health birth and death data to the natural increase components that they (Census) generated contemporaneously with each successive vintage of estimates.

We examined how they used these previously provided vital records data in order to evaluate how they might interpret the most recently provided data in the production of the July 1, 2015 estimates. Table 2 below displays the data provided by the UDOH and the associated estimates generated contemporaneously by the Census for each vintage year. From this we have inferred how Census might interpret the most recently provided vital records in the production of the July 1, 2015 estimates.

This exercise shows us that Census has generally used birth estimates that are higher and death estimates that are lower than the data provided by the UDOH. The result is annual natural increase estimates that are consistently higher than what the UDOH data indicate. We used these ranges of observed differences to construct relative ranges around the fiscal year 2015 vital record data that has been provided to Census as they construct the July 1, 2015 estimates. From this, we evaluated potential ranges of variation in the natural increase component of the July 1, 2015 estimation work.

Table 2
 Comparison of Natural Increase Components:
 Utah Department of Health and Various Vintages of Census Estimates

Vital Records Provide by the Utah Department of Health

	FY2011	FY2012	FY2013	FY2014	FY 2015
Deaths	14,856	15,685	16,511	15,941	16,942
Births	51,666	50,159	51,511	50,541	50,774
Natural Increase	36,810	34,474	35,000	34,600	33,832

Census Data Various Vintages

	FY2011	FY2012	FY2013	FY2014	FY 2015
Deaths	14,314	14,826	14,875	15,306	
Births	52,003	51,071	50,840	51,447	
Natural Increase	37,689	36,245	35,965	36,141	-

Absolute Differences

	FY2011	FY2012	FY2013	FY2014	Average
Deaths	-542	-859	-1,636	-635	-918
Births	337	912	-671	906	371
Natural Increase	879	1,771	965	1,541	1,289

Relative Differences

	FY2011	FY2012	FY2013	FY2014	Average
Deaths	-3.6%	-5.5%	-9.9%	-4.0%	-5.8%
Births	0.7%	1.8%	-1.3%	1.8%	0.7%
Natural Increase	2.4%	5.1%	2.8%	4.5%	3.8%

Note: Census data is from the 2011, 2012, 2013, and 2014 vintages.

Combining the largest positive deviation of the birth data (1.8 percent) with the largest negative deviation of the death data (-9.9 percent) and applying these to the UDOH data for FY 2015 yields an extreme upper value for natural increase of 36,434. The other extreme values (-3.6 percent for deaths and -1.3 percent for births) applied to the same UDOH data result in a lower bound natural increase of 33,789. These are shown in Table 3 below.

Table 3: Census 2015 Estimates:
Computed Extreme Ranges for Natural Increase Component

	2015 UDOH Data	Most Natural Increase	Least Natural Increase
Deaths	16,942	15,263	16,324
Births	50,774	51,697	50,113
Natural Increase	33,832	36,434	33,789

Migration

Estimated annual net international migration has been increasing with more consistency in the 2014 vintage estimates produced by Census. A simple linear regression fits the data reasonably well ($R^2 = 0.9188$) and this extrapolation generates a value of 5,741 for FY 2015. A range of 5,166 to 6,315 (10 percent variation around the estimate) is used here in an attempt to portray some amount of uncertainty.

Net domestic migration estimates produced by the Census in the 2014 vintage estimates are very erratic. Three of the past four years have estimated net domestic out-migration. Given the time lags in the data sources used by Census as well as the uncertainty about the combined effects of their modeling and “raking” procedures, the uncertainty around this component is relatively large. For this exercise, we have bracketed the net domestic migration as a potential out-migration of 1,000 and in-migration of 7,000. We considered this higher in-migration given their data sources, the improvement of economic conditions, and the request of GOMB that we review a scenario in which 2.99 million is Census estimate for July 1, 2015. A July 1, 2015 population estimate of 2.99 million for Utah results with the highest range for all component estimates.

Residuals in the 2014 vintage estimates oscillate from positive to negative with the ranges increasing. Given the uncertainty about how these have been generated by Census, we apply a range of negative 300 to positive 300 to our ranges of the potential July 1, 2015 population estimate to be generated by the Census.

Estimate Range

Combining the extremes of each of these components, we compute a range of 2,980,557 to 2,992,950 as a prediction for the July 1, 2015 estimates to be produced by Census. The former is 19,443 short and the latter is 7,050 less than the magic 3 million. The average (more likely) of the two extreme values is 2,986,754, which is 13,246 less than 3 million.

We complete the exercise, by simply computing ratio of each “gap to 3 million” to the corresponding computed absolute annual increase in population for the previous fiscal year. For example, 19,433 is 51.6 percent of 37,655. This ratio is applied to 365 days to generate 188 days. Day 188 in FY 2016 is January 4, 2016.

From this exercise, we infer that the Census estimate will show Utah to have 3 million residents any time from August 20, 2015 (day 51) to January 4, 2016 (day 188). The midrange estimate is October 18, 2015 (day 110).

Importantly, this work does not independently estimate the day that Utah reaches 3 million. Rather, the point of this exercise is to evaluate when we think that the methods and data of the Population Estimates Program of the Census Bureau will indicate a population of 3 million.

Table 4: Computed Ranges of Census Population Estimates:
Extreme Ranges Combined and Resulting Average

	Natural Increase	Net International Migration	Net Domestic Migration	Residual	Increase from 2014	July 1, 2015 Estimate	Gap to 3 Million	Gap as % of Annual Increase	Days into FY 2016
Lowest	33,789	5,166	-1,000	-300	37,655	2,980,557	19,443	51.6%	188
Highest	36,434	6,315	7,000	300	50,048	2,992,950	7,050	14.1%	51
Midpoint	35,111	5,741	3,000	0	43,852	2,986,754	13,246	30.2%	110

Note: These estimates of the day that Census estimates for the Utah population reach 3 million have been generated by applying extreme high and low range assumptions for the components of change. The midpoint is the simple average of the two extreme scenarios.

Continue Work

In the coming months the Kem C. Gardner Policy Institute will be forming and convening a DemographyUTAH Population Committee to prepare annual state- and county-level population estimates for Utah on an ongoing basis. The Committee will be comprised of data providers and will implement a methods and data-driven technical process to prepare local estimates. This will enable our state to produce high-quality population estimates that we can use in planning and budgeting decisions. This work will also allow us to more rigorously review the estimates produced by the U.S. Census Bureau. We look forward to collaborating with your staff on this work and appreciate our partnership.