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Utah Population Committee Postcensal Estimates Accuracy Analysis, 2010-2020

Introduction

Compared with the count from the 2020 census, the Utah Population Committee (UPC) population estimate of 3,259,792 underestimated the state count by 11,824 people or .4%. When considering the individual methods used in UPC, the Housing Stock method was the most accurate, while the LDS method was the least at the state level. The performance of the UPC estimates compared to the 2020 census and the individual UPC methods varied by county.

This analysis provides insights into the accuracy of the UPC state and county estimates from the 2010-2020 postcensal period, including the individual methods that comprise the published UPC estimates. We assess the accuracy of the overall UPC estimates and each method and then discuss potential changes and improvements for the 2020-2030 postcensal estimates.

UPC Accuracy

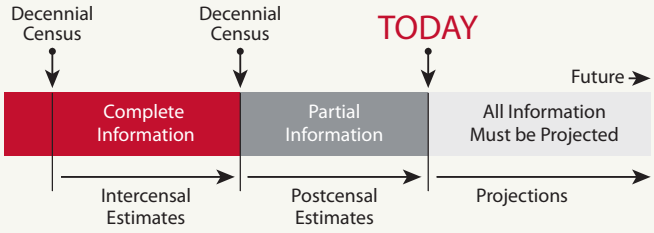
The UPC population estimate underestimated the state count by 11,824 people or .4%. The UPC estimate was 3,259,792 compared to the 2020 census count of 3,271,616. UPC state estimates are the sum of county estimates, and these county-level results' accuracy varies. Generally, UPC **overestimated** rural counties and Washington and Utah counties while **underestimating** most counties in the Wasatch Front, Northern Utah, and Iron County. The maps below show the absolute and percentage difference between the UPC estimates and the 2020 decennial count at the county level.

The UPC created April 1, 2020 state and county population estimates to compare to the 2020 decennial census counts directly. This paper measures accuracy using absolute and percentage differences in the April 1, 2020 estimates and decennial counts to understand overall performance. The 2020 census counts are the most timely and accurate measure of the total population. Thus we view UPC estimates performance as either over or under-estimating the true population for April 1, 2020.

Postcensal and Intercensal Population Estimates:

The start of each decade, along with new decennial Census data, ends the previous decade's postcensal estimates. These postcensal estimates are then revised into intercensal estimates to more accurately represent the population, using the previous and current decennial data as starting and ending points.

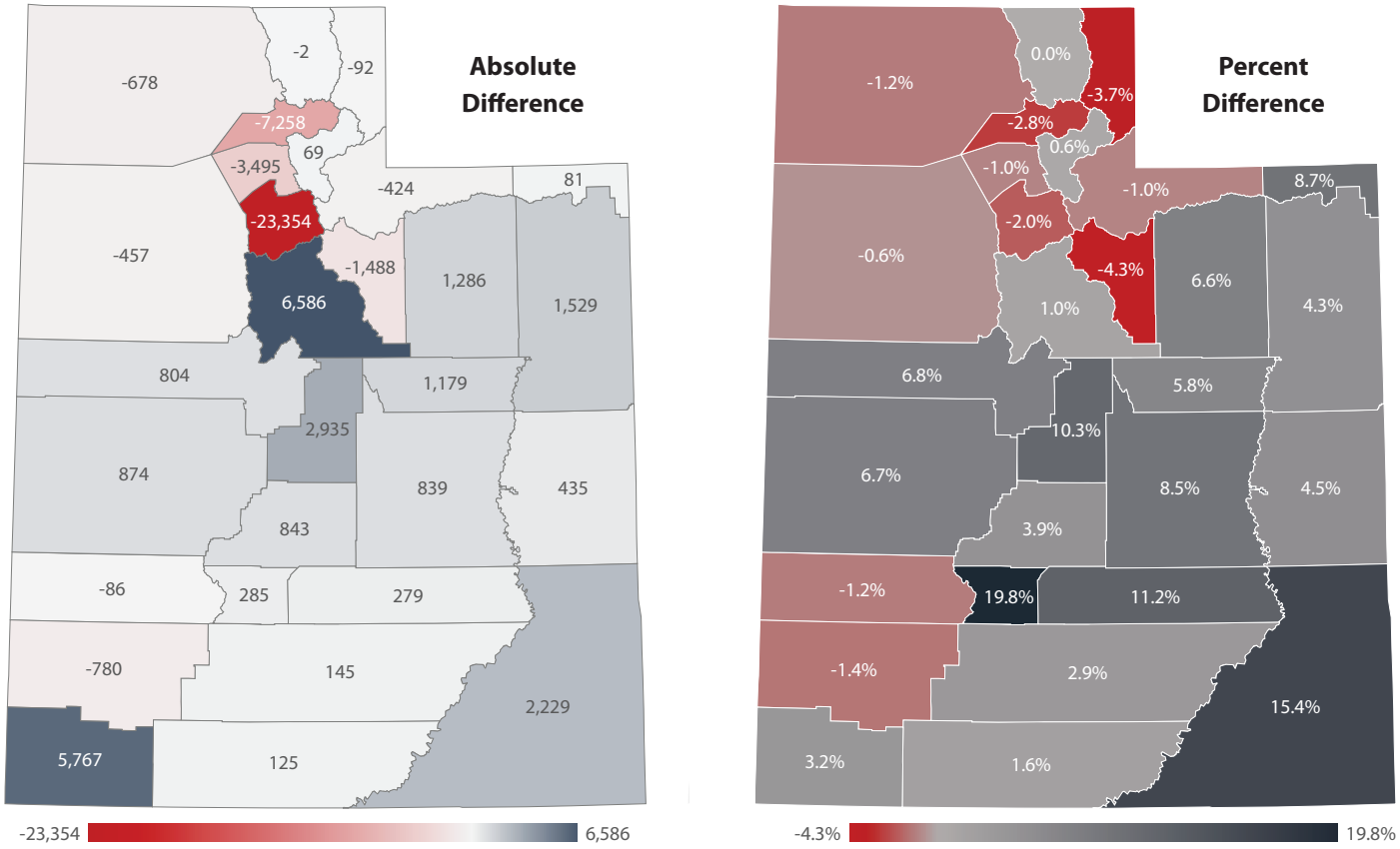
Figure 1. Intercensal Estimates, Postcensal Estimates, and Projections



Source: Kem C. Gardner Policy Institute

- **Postcensal estimates** – Population estimates created throughout the decade based on the most recent decennial census count.
- **Intercensal estimates** – Revised population estimates bookended by two decennial census counts. Postcensal population estimates are turned into intercensal estimates once there is a new decennial census count.

Figure 2. UPC Over and Under Estimation by County, Absolute and Percent Difference, April 1, 2020



Source: Kem C. Gardner Policy Institute analysis of UPC Estimates

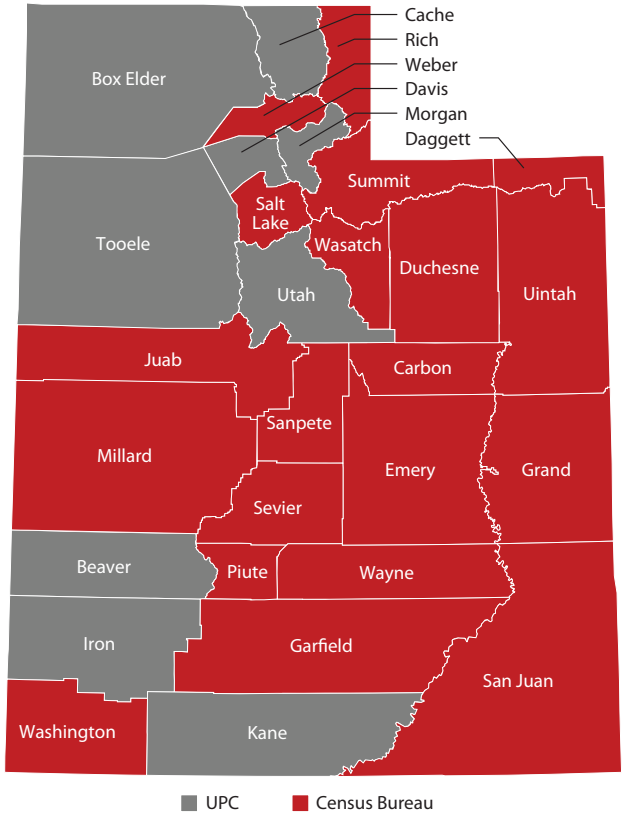
UPC and Census Bureau: State and Counties

At the state level, UPC estimates (3,259,792) were closer to the decennial count than the Census Bureau estimates (3,238,255) by 21,537.[1] However, estimates' performance was not uniform across Utah's counties.

UPC population estimates were **more accurate** for many northern Utah counties and part of southwestern Utah. In contrast, the Census Bureau population estimates were **more accurate** for a larger number of counties, particularly rural Utah and three of the five most populous counties. See Table 2, Appendix B for full county estimates comparisons.

The Census Bureau produces annual population estimates for all states, counties, and small areas in the nation and is the primary source for comparison to UPC county estimates. Data and methodology differences exist between the Census Bureau and UPC population estimates, creating differences in state and county populations.[2]

Figure 3. Best Performing Population Estimate by County, UPC, and Census Bureau, April 1, 2020



Note: UPC and Census Bureau estimates were very close in seven counties: Box Elder, Daggett, Davis, Iron, Morgan, Salt Lake, & Sanpete.
Source: Kem C. Gardner Policy Institute analysis of UPC Estimates

Table 1. Summary of Differences between UPC and Census Bureau estimates

	UPC	Census Bureau
Inputs	Vital Records (births, deaths) 4 Methods – LDS Membership, IRS Exemption, Housing Stock, and School Enrollment.	Vital Records (births, deaths) IRS Data, Medicare Data, Social Security Administration's Numerical Identification File, Group Quarters Populations
Methodology (Counties)	**Net Migration = Current Population Estimate – Previous Population Estimate – Births – Deaths**	**Population Base + Births – Deaths + Migration = Population Estimate**

Source: Kem C. Gardner Policy Institute analysis of UPC Estimates, based on data from Utah State Board of Education, Utah Taxpayers Association, the Church of Jesus Christ of Latter-day Saints, and the Ivory-Boyer Database.

Table 2. Decadal Percent Difference and Mean Absolute Percent Error by Method, 1990-2020

	Housing	IRS	LDS	School	UPEC/UPC	Census
1990-2000	-1.1%	-0.1%	-8.1%	-5.6%	-3.6%	-3.1%
2000-2010	1.9%	5.8%	-6.0%	4.9%	2.4%	2.0%
2010-2020	0.37%	-3.0%	-5.7%	1.2%	-0.36%	-1.0%
MAPE	**1.1%**	**3.0%**	**6.6%**	**3.9%**	**2.1%**	**2.0%**

Source: Kem C. Gardner Policy Institute analysis of UPC Estimates, based on data from Utah State Board of Education, Utah Taxpayers Association, the Church of Jesus Christ of Latter-day Saints, and the Ivory-Boyer Database.

UPC Methods and Data

UPC averages the results of four different methods to produce population estimates for each county. The state total population estimate is the sum of these county totals. The estimates represent the population on July 1 of each year.

The methods used in the 2010-2020 estimates were: LDS Membership, IRS Exemption, Housing Stock, and School Enrollment. Details regarding methodology and results for each are in Appendix A.

Individual Method Results and Comparisons

Just as the UPC and Census Bureau estimates proved to perform differently across counties, each method (Housing Stock, IRS, LDS, and School Enrollment) has different assumptions and data that perform differently depending on the county. Additionally, these methods tend to perform differently each decade. These differences across geographies and time reiterate the need for an accuracy analysis at the end of each decade to evaluate how and why the methods' performance varies.

Table 2 displays each method's performance at the state level for the last three decades. Highlights indicate the most accurate method, while the least accurate method is in red. While the LDS method has consistently been the least accurate, the most accurate method changes each decade. Most recently, the overall UPC estimate was the most accurate, but the housing stock method was the most accurate across the three-decade span according to the Mean Absolute Percent Error (MAPE) from 1990 to 2020.

At the county level, there is a wide range of method performance. The most accurate methods for the largest number of counties were the Housing Stock and School Enrollment methods, with each method performing the best for seven counties. Differences emerge between methods when examining the highest error methods. The School Enrollment and LDS methods performed the least accurately for 11 and 10 counties, respectively, much more than the Housing Stock, IRS, and UPC methods.

Tables 3, 4, and 5 in the Appendix display each method's 2020 estimates, the percent error from the 2020 Census, and the Absolute Percent Error (APE) from the 2020 Census.

Housing Stock

The housing stock method performed the best of all the individual methods at the state level (within 0.37%) and performed most accurately for the largest number of counties. In general, it overestimated population (17 counties, including Salt Lake and Utah counties) and overestimated severely in rural central and eastern counties. It underestimated the population in 12 counties, notably in Tooele, Wasatch, Iron, Morgan, and Summit counties.

The housing stock method assumes housing growth equals population growth. It also assumes a 6-month timeline from permitting to occupancy. These assumptions can cause high population estimates if construction takes more than 6 months (typical for large multifamily units) or if a generous share of new homes are secondary homes.

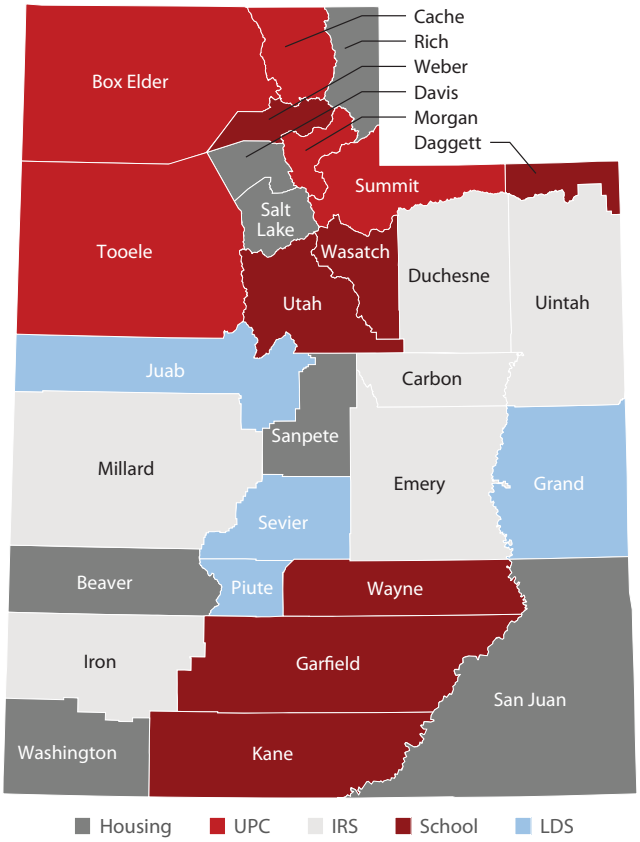
IRS

**This method compares the IRS method 2018 estimates to the UPC Intercensal 2018 population estimate. IRS data changes in 2019 caused UPC to pause the IRS Method for 2019 and 2020.*

The IRS method underestimated the state's total population by 3.0%. It overestimated 17 of Utah's counties, mostly in rural and southwestern Utah, with the largest overestimation in Daggett and San Juan counties. It underestimated the population in the Greater Salt Lake Economic Region, with the state's largest underestimation occurring in Salt Lake County.

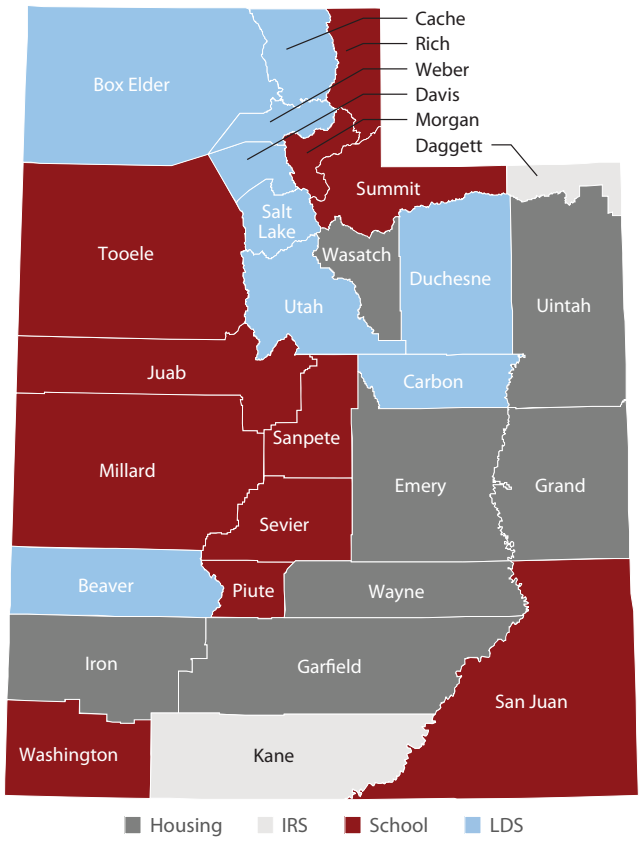
Figure 4. Highest and Lowest Error Method by County, July 1, 2020

Lowest Error Method by County



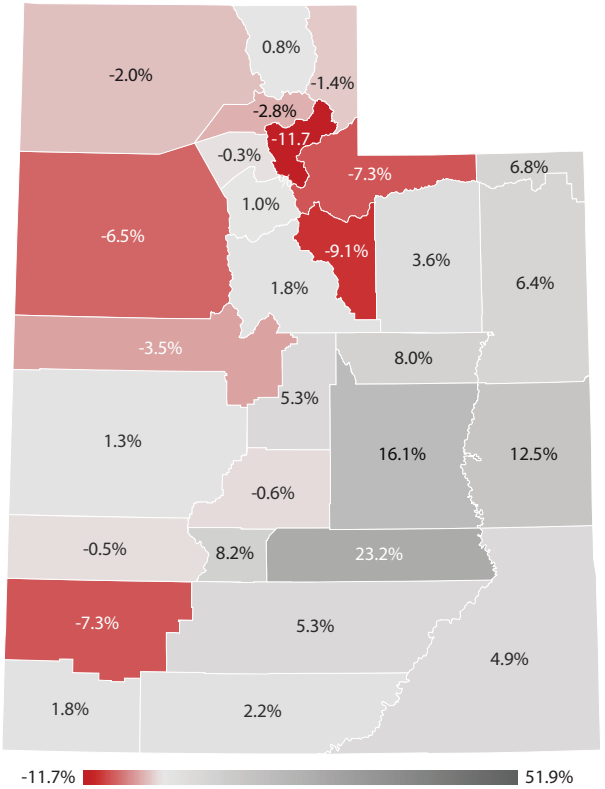
Source: Kem C. Gardner Policy Institute analysis of UPC Estimates

Highest Error Method by County



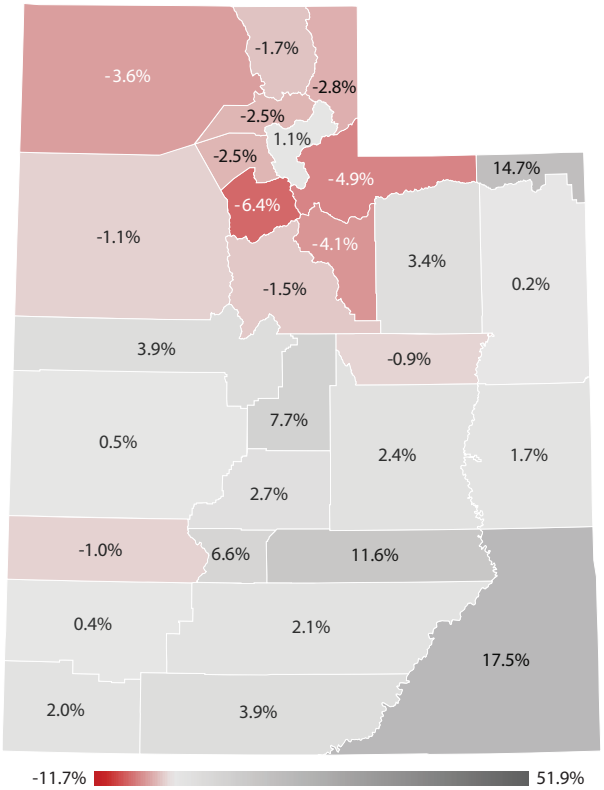
Source: Kem C. Gardner Policy Institute analysis of UPC Estimates

Figure 5. Housing Stock Method Error by County, April 1, 2020



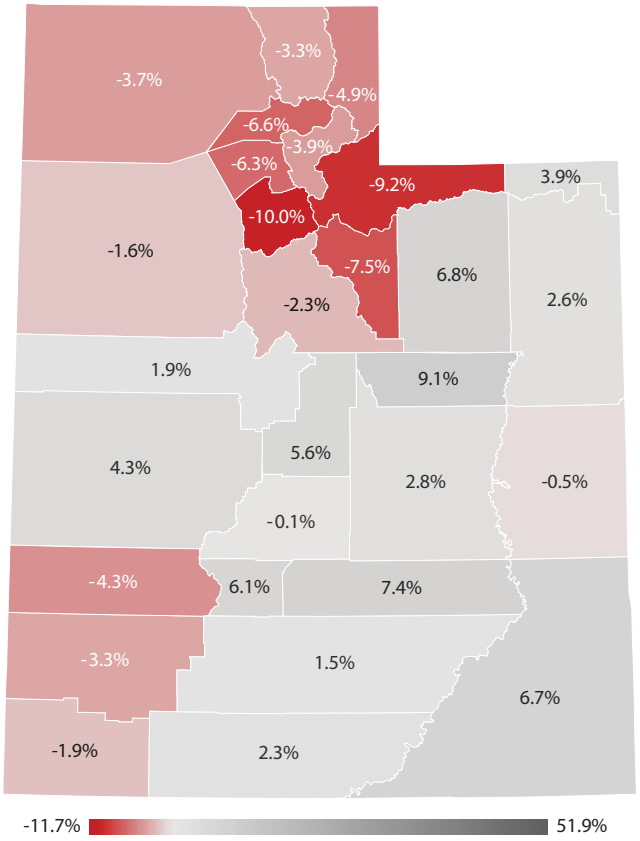
Source: Kem C. Gardner Policy Institute analysis of UPC Estimates

Figure 6. IRS Method Error by County April 1, 2020



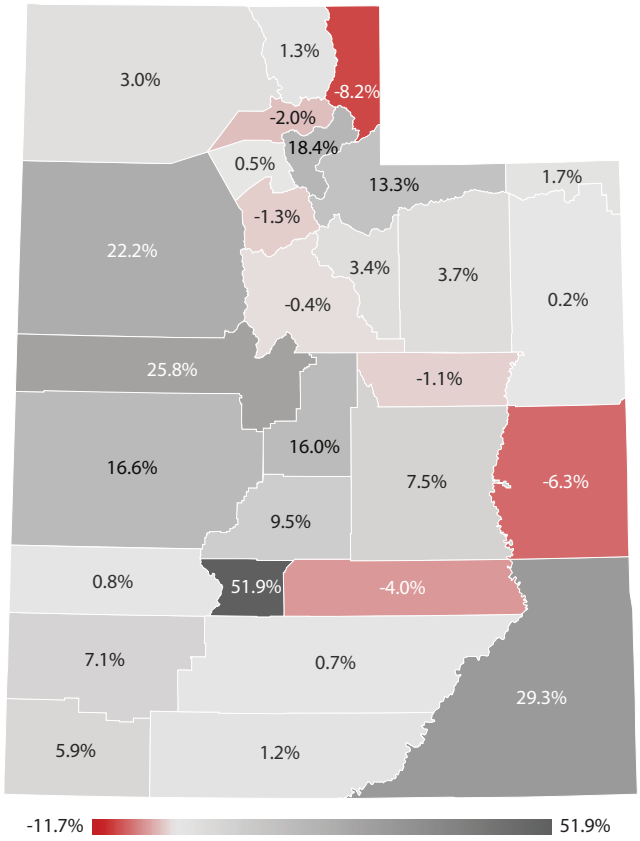
Source: Kem C. Gardner Policy Institute analysis of UPC Estimates

Figure 7. LDS Method Error by County
April 1, 2020



Source: Kem C. Gardner Policy Institute analysis of UPC Estimates

Figure 8. School Enrollment Method Error by County, April 1, 2020



Source: Kem C. Gardner Policy Institute analysis of UPC Estimates

The IRS exemption data does not capture the entire population, so the IRS method assumes a constant exemption-to-population ratio. This ratio can change over time if there is a change in the proportion of residents filing tax returns.

LDS

The LDS method consistently underestimated the state population by 5.7% and is one of the least accurate methods at the county level. This method overestimated 13 counties this decade, mostly rural, while it underestimated 16 counties, with the most error in the Wasatch Front region and other fast-growing counties.

The LDS method assumes that church membership is a constant proportion of the population. The LDS population is declining as a share of the state's total population, leading to lower population estimates, particularly for fast-growing counties.

School Enrollment

The School Enrollment method overestimated the state's total population by 1.2%, the most of any method. It overestimated population in 22 counties, with the largest overestimation occurring in counties adjacent to the Wasatch Front and rural Utah: Tooele, Juab, Summit, Piute, and San Juan counties.

The school enrollment method assumes a constant student-to-population ratio. This assumption also implies that the population's age structure and share of school-age children enrolled in public schools (as opposed to private schools) are constant. As the population ages from higher life expectancy and slowing fertility, this can cause overestimation.

Next Steps for 2020-2030

This accuracy analysis provides:

- insights into the UPC's population estimates' performance over the last decade;
- a chance to learn how different circumstances impact the individual methods' performances;
- an opportunity to reflect on changes UPC should make for creating population estimates over the next decade.

With the new 2020 decennial data release, UPC starts with a new set of estimates and can adjust the existing methods to use the data more appropriately. Considerations for the next decade of estimates include:

1. **LDS Method -** The first and most drastic change is that UPC will no longer use the LDS method. The membership data is no longer being shared with entities outside the Church of Jesus Christ of Latter-Day Saints and is therefore not an option for the UPC process.
2. **School Enrollment Data** - As online schooling has become more popular, along with charter schools, residential adjustments have become more complicated and require more expert knowledge to examine and interpret. UPC will continue to fine-tune, document, and standardize the adjustments made to the enrollment data throughout the decade.
3. **Housing Stock Timing** - The current housing stock method tends to oversimplify the timing from building permit to occupied home. The majority of new construction over the last decade has been in multifamily units rather than single-family homes, meaning that previous assumptions on construction timing need some adjustments.[3] These changes are leading UPC to explore a more traditional housing unit method that incorporates different lag times for different housing units and different occupancy assumptions based on the type of permit.
4. **Production Schedule** - UPC is considering changing the timing of the annual population estimates and their release. The current production schedule involves a November meeting and then releasing the estimates in December. However, a later meeting and release date may be more advantageous to allow more data processing and meeting time before releasing the estimates.
5. **Methodological Approaches** - Incorporating a commonly used regression-based method into the UPC average could provide more stability to the estimates since the LDS method is no longer included. The ratio-correlation method is an extensively researched and popular method used by other states.[4] We plan to explore whether this is a realistic incorporation or not.

Appendix A: 2010-2020 Methodology and Estimates Adjustments

UPC Methodology

Three (LDS, IRS, and Housing Stock) of the four estimation methods use the standard residual method of population estimation. County population estimates for July 1 are derived by computing fiscal year changes in symptomatic data and applying these to the previous year's population. Fiscal year natural increase (births minus deaths) is subtracted from the updated population estimate to derive net migration as the residual.

$$NM = (P_t - P_{t-1}) - (Births - Deaths)$$

where NM = Net Migration (for the fiscal year from t-1 to t)
P = population (stock variable at a point in time)
B = Births (total for the fiscal year from t-1 to t)
D = Deaths (total for the fiscal year from t-1 to t)
t = Time

One method, the School Enrollment Method, uses the cohort approach in three steps using the following equations:

1. Implied student migration $_{(t\text{-}1 \text{ to } t)}$ =

$$\left[\left(\begin{array}{c}\text{School Enrollment}\\ \text{Grades } 2\text{–}9_t\end{array}\right) - \left(\begin{array}{c}\text{School Enrollment}\\ \text{Grades } 1\text{–}8_{t-1}\end{array}\right)\right] \times .9998$$

2. Net migration $_{(t\text{-}1 \text{ to } t)}$ =

$$\frac{P_{t-1}}{\text{School Enrollment Grades } 1\text{–}8_{t-1}} \times \begin{array}{c}\text{Implied student}\\ \text{migration}_{(t\text{-}1 \text{ to } t)}\end{array}$$

3. $P_t = P_{t-1} + (Births - Deaths) + Net\ Migration_{t-1 \text{ to } t}$

where P = population (stock variable at a point in time)
B = Births (total for the fiscal year from t-1 to t)
D = Deaths (total for the fiscal year from t-1 to t)
t = Time

This method estimates net migration instead of the current population estimate, using the above formula (equation 3) to calcuate the population estimate.

School Enrollment Method

The School Enrollment Method uses aged and survived changes in school enrollment as an indicator of net migration. UPC incorporates updated annual enrollment counts from each county provided by the Utah State Board of Education (USBE).[5] This method compares a county's survived enrollment (calculated by applying a survival rate of 99.98% to the enrollment count) in grades 1 to 8 for the year prior to enrollment in grades 2 to 9 for the estimate year. The difference between these two enrollment totals is considered the net student migration for the county.

Total net migration from the school enrollment method for the county is then derived by multiplying the county's student migration estimate by the county specific total population to student ratio. This ratio is defined as the total population estimate of the county for the prior year divided by the same year's enrollment in grades 1 to 8.

LDS Membership Method

This method applies the annual growth rate in The Church of Jesus Christ of Latter-day Saints (LDS) membership to the previous year's population estimate for the county. The growth in LDS membership is used as an indicator of population growth. This membership data is provided to UPC by their representative on the committee. [6]

However, the changes in missionary migration patterns in 2013 through 2015 (due to the missionary age change) significantly altered county annual shares of the LDS population. UPC incorporated a missionary adjustment to account for the annual increments in active missionaries by county by using the same membership dataset with active missionaries excluded. These differences are subtracted from the initial population estimate produced by the LDS method, which creates an adjusted LDS method population estimate series.[7]

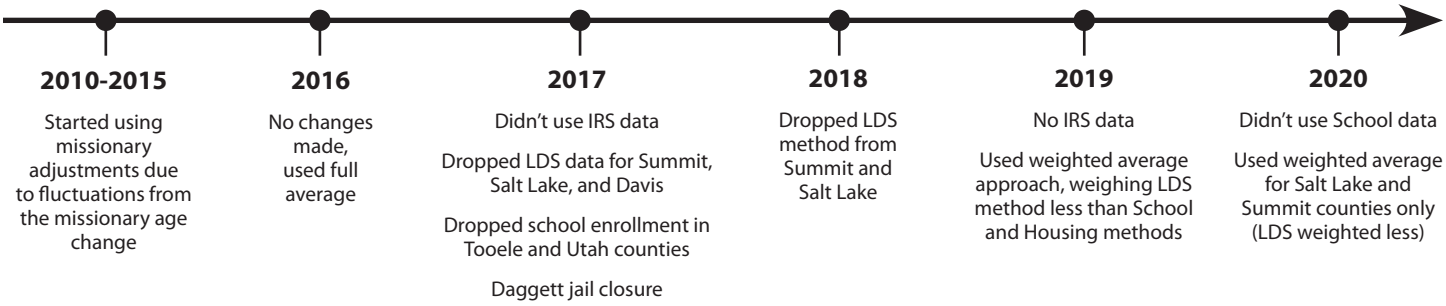
IRS Method

This method uses the growth in IRS tax exemptions as reported on tax returns filed with the IRS as an indicator of population change. The Utah State Tax Commission provides UPC with data containing the annual counts of the number of tax returns and exemptions filed by county. The current population estimate uses a growth rate from the sum of exemptions from two years prior and from the year prior to the current year (i.e., the 2010 IRS method uses 2008 and 2009 calendar year exemptions to generate the growth rate). The growth rate in exemptions is then applied to the previous fiscal year's population to estimate the current fiscal year's population. [8] [9]

Housing Stock Method

The method starts with the current housing stock by adding the previous calendar year's approved permit data from Ivory Boyer Construction Database (multiplied by a factor of 1.0389[10]) to the previous year's housing stock. Then, the annual growth rate in the current housing stock is applied to the previous year's July 1 population estimate to develop the current year's July 1 estimate.

Figure 9. UPC Method Adjustments, 2010-2020



The UPC encountered some consistent issues:

- The LDS membership data was not a good population indicator for lower membership or declining membership counties such as Salt Lake and Summit counties
- The IRS data was sometimes inconsistent, experiencing a series break after the 2017 federal tax code changes, leaving the UPC with no IRS data for 2019.

Appendix B: Population Estimates Accuracy Analysis Supplemental Tables

Table 3. Method Postcensal Population Estimates, April 1, 2020

County	April 1, 2020 Estimates					
	Average	LDS 2020	IRS 2018	School 2020	Housing 2020	UPC 2020
Beaver County	6,978	6,767	6,908	7,127	7,039	6,986
Box Elder County	57,146	55,517	54,193	59,384	56,537	56,988
Cache County	132,611	128,759	126,661	134,908	134,166	133,152
Carbon County	21,502	22,271	20,240	20,185	22,052	21,591
Daggett County	973	971	1,050	951	999	1,016
Davis County	355,212	339,736	346,938	364,388	361,512	359,184
Duchesne County	20,517	20,922	20,464	20,330	20,298	20,882
Emery County	10,691	10,104	10,219	10,566	11,405	10,664
Garfield County	5,209	5,157	5,217	5,118	5,353	5,228
Grand County	9,851	9,621	10,073	9,059	10,874	10,104
Iron County	56,615	55,390	55,037	61,368	53,089	56,509
Juab County	12,737	12,006	11,961	14,830	11,377	12,590
Kane County	7,813	7,842	7,911	7,760	7,838	7,792
Millard County	13,939	13,533	12,924	15,134	13,150	13,849
Morgan County	12,413	11,820	12,034	14,557	10,862	12,364
Piute County	1,755	1,525	1,522	2,184	1,556	1,723
Rich County	2,389	2,388	2,434	2,305	2,474	2,418
Salt Lake County	1,144,654	1,066,563	1,087,417	1,170,253	1,197,147	1,161,884
San Juan County	16,500	15,497	17,212	18,770	15,232	16,747
Sanpete County	30,993	30,042	30,322	32,999	29,936	31,372
Sevier County	22,151	21,496	21,814	23,558	21,399	22,365
Summit County	41,899	38,461	39,576	47,984	39,254	41,933
Tooele County	76,119	71,526	68,471	88,824	68,006	72,241
Uintah County	36,705	36,539	35,724	35,685	37,892	37,149
Utah County	657,246	644,172	618,586	656,560	671,005	665,985
Wasatch County	33,259	32,165	31,987	35,986	31,626	33,300
Washington County	183,757	176,871	169,585	190,912	183,490	186,046
Wayne County	2,706	2,669	2,814	2,386	3,062	2,765
Weber County	252,309	244,956	251,223	257,009	254,962	254,965
State	**3,226,653**	**3,085,288**	**3,080,517**	**3,311,080**	**3,283,591**	**3,259,792**

Source: Kem C. Gardner Policy Institute analysis of UPC Estimates, based on data from Utah State Board of Education, Utah Taxpayers Association, the Church of Jesus Christ of Latter-day Saints, and the Ivory-Boyer Database.

Table 4. Method Postcensal Population Estimates Percent Difference, April 1, 2020

	Percent Error from April 1, 2020 Count					
	3 method average 2020	LDS 2020	IRS 2018	School 2020	Housing 2020	UPC 2020
Beaver County	-1.3%	-4.3%	-1.0%	0.8%	-0.5%	-1.2%
Box Elder County	-0.9%	-3.7%	-3.6%	3.0%	-2.0%	-1.2%
Cache County	-0.4%	-3.3%	-1.7%	1.3%	0.8%	0.0%
Carbon County	5.3%	9.1%	-0.9%	-1.1%	8.0%	5.8%
Daggett County	4.1%	3.9%	14.8%	1.7%	6.8%	8.7%
Davis County	-2.1%	-6.3%	-2.5%	0.5%	-0.3%	-1.0%
Duchesne County	4.7%	6.8%	3.4%	3.7%	3.6%	6.6%
Emery County	8.8%	2.8%	2.4%	7.5%	16.1%	8.5%
Garfield County	2.5%	1.5%	2.1%	0.7%	5.3%	2.9%
Grand County	1.9%	-0.5%	1.7%	-6.3%	12.5%	4.5%
Iron County	-1.2%	-3.3%	0.4%	7.1%	-7.3%	-1.4%
Juab County	8.1%	1.9%	3.9%	25.8%	-3.5%	6.8%
Kane County	1.9%	2.3%	3.9%	1.2%	2.2%	1.6%
Millard County	7.4%	4.3%	0.5%	16.6%	1.3%	6.7%
Morgan County	1.0%	-3.9%	1.1%	18.4%	-11.7%	0.6%
Piute County	22.1%	6.1%	6.6%	51.9%	8.2%	19.8%
Rich County	-4.8%	-4.9%	-2.8%	-8.2%	-1.4%	-3.7%
Salt Lake County	-3.4%	-10.0%	-6.4%	-1.3%	1.0%	-2.0%
San Juan County	13.6%	6.7%	17.5%	29.3%	4.9%	15.4%
Sanpete County	9.0%	5.6%	7.7%	16.0%	5.3%	10.3%
Sevier County	2.9%	-0.1%	2.7%	9.5%	-0.6%	3.9%
Summit County	-1.1%	-9.2%	-4.9%	13.3%	-7.3%	-1.0%
Tooele County	4.7%	-1.6%	-1.1%	22.2%	-6.5%	-0.6%
Uintah County	3.0%	2.6%	0.2%	0.2%	6.4%	4.3%
Utah County	-0.3%	-2.3%	-1.5%	-0.4%	1.8%	1.0%
Wasatch County	-4.4%	-7.5%	-4.1%	3.4%	-9.1%	-4.3%
Washington County	1.9%	-1.9%	2.0%	5.9%	1.8%	3.2%
Wayne County	8.8%	7.4%	11.6%	-4.0%	23.2%	11.2%
Weber County	-3.8%	-6.6%	-2.5%	-2.0%	-2.8%	-2.8%
State	**-1.4%**	**-5.70%**	**-3.02%**	**1.21%**	**0.37%**	**-0.36%**

Source: Kem C. Gardner Policy Institute analysis of UPC Estimates, based on data from Utah State Board of Education, Utah Taxpayers Association, the Church of Jesus Christ of Latter-day Saints, and the Ivory-Boyer Database.

Table 5. Method Postcensal Population Estimates Absolute Percent Error, April 1, 2020

	Absolute Percent Error from April 1, 2020 Count						
	LDS 2020	IRS 2018	School 2020	Housing 2020	UPC 2020	Least Error	Most Error
Beaver County	4.3%	1.0%	0.8%	0.5%	1.2%	Housing	LDS
Box Elder County	3.7%	3.6%	3.0%	2.0%	1.2%	UPC	LDS
Cache County	3.3%	1.7%	1.3%	0.8%	0.0%	UPC	LDS
Carbon County	9.1%	0.9%	1.1%	8.0%	5.8%	IRS	LDS
Daggett County	3.9%	14.8%	1.7%	6.8%	8.7%	School	IRS
Davis County	6.3%	2.5%	0.5%	0.3%	1.0%	Housing	LDS
Duchesne County	6.8%	3.4%	3.7%	3.6%	6.6%	IRS	LDS
Emery County	2.8%	2.4%	7.5%	16.1%	8.5%	IRS	Housing
Garfield County	1.5%	2.1%	0.7%	5.3%	2.9%	School	Housing
Grand County	0.5%	1.7%	6.3%	12.5%	4.5%	LDS	Housing
Iron County	3.3%	0.4%	7.1%	7.3%	1.4%	IRS	Housing
Juab County	1.9%	3.9%	25.8%	3.5%	6.8%	LDS	School
Kane County	2.3%	3.9%	1.2%	2.2%	1.6%	School	IRS
Millard County	4.3%	0.5%	16.6%	1.3%	6.7%	IRS	School
Morgan County	3.9%	1.1%	18.4%	11.7%	0.6%	UPC	School
Piute County	6.1%	6.6%	51.9%	8.2%	19.8%	LDS	School
Rich County	4.9%	2.8%	8.2%	1.4%	3.7%	Housing	School
Salt Lake County	10.0%	6.4%	1.3%	1.0%	2.0%	Housing	LDS
San Juan County	6.7%	17.5%	29.3%	4.9%	15.4%	Housing	School
Sanpete County	5.6%	7.7%	16.0%	5.3%	10.3%	Housing	School
Sevier County	0.1%	2.7%	9.5%	0.6%	3.9%	LDS	School
Summit County	9.2%	4.9%	13.3%	7.3%	1.0%	UPC	School
Tooele County	1.6%	1.1%	22.2%	6.5%	0.6%	UPC	School
Uintah County	2.6%	0.2%	0.2%	6.4%	4.3%	IRS	Housing
Utah County	2.3%	1.5%	0.4%	1.8%	1.0%	School	LDS
Wasatch County	7.5%	4.1%	3.4%	9.1%	4.3%	School	Housing
Washington County	1.9%	2.0%	5.9%	1.8%	3.2%	Housing	School
Wayne County	7.4%	11.6%	4.0%	23.2%	11.2%	School	Housing
Weber County	6.6%	2.5%	2.0%	2.8%	2.8%	School	LDS
State	5.7%	3.0%	1.2%	0.4%	0.4%	UPC	LDS

Source: Kem C. Gardner Policy Institute analysis of UPC Estimates, based on data from Utah State Board of Education, Utah Taxpayers Association, the Church of Jesus Christ of Latter-day Saints, and the Ivory-Boyer Database.

Endnotes

1. Bateman, M. 2021. [Blog] 2020 Census Apportionment Data Released. Accessed at https://gardner.utah.edu/blog-2020-census-apportionment-data-released/
2. Census Bureau. 2023. METHODOLOGY FOR THE UNITED STATES POPULATION ESTIMATES: VINTAGE 2022. Accessed at https://www2.census.gov/programs-surveys/popest/technical-documentation/methodology/2020-2022/methods-statement-v2022.pdf
3. Kem C. Gardner Policy Institute. 2020. Ivory-Boyer Construction Report: Year End 2019. Accessed at https://gardner.utah.edu/wp-content/uploads/ConstRept-2019Q4.pdf?x71849
4. Swanson, D., and Tayman, J. 2012. Regression Methods. Chapter 8 in *Subnational Population Estimates*. Springer.
5. Data selection criterion consists of: state residency, enrolled in public local education or charter schools, enrolled on October 1st, at least one day of enrollment in regular or special education programs, enrolled in a grade level from Kindergarten to 12th grade, students attending the state sponsored deaf and blind schools, and foreign exchange students.
6. The LDS membership data is extracted annually on September 30 in order to capture a more accurate representation of the usual population of counties in Utah, especially those counties with large university populations.
7. This method change is particularly useful for the years 2013 through 2015 as a means to track the unusual increases and decreases in active missionaries by county. The data enables us to explain and interpret these effects, particularly migration, on the resident population.
8. An important point to note: previous UPEC methods used different forms of IRS exemptions in 2010 and 2011 due to certain tax-filing patterns for those years, and then used the non-restricted exemptions from 2012-2014, so we followed suit. The IRS 2010 estimates used the 2008 and 2009 total exemptions from returns with Federal Adjusted Gross Income (FAGI) exceeding $10,000. The 2011 IRS method was based on total exemptions from all 2009 and 2010 returns with positive FAGI. The 2012 estimates and on used the full, non-restricted exemptions.
9. The federal tax changes in 2017 created a series break in the IRS exemption data. UPC wasn't able to use IRS data again until there were two consecutive years with the new filing criteria, meaning the IRS method was not used in 2019.
10. Utah Population Estimates Committee. (2010). 2009 Population Estimates: Methods Documentation. Retrieved from http://governor.utah.gov/DEA/Publications/04Estimates/2009MethodsDocumentation.pdf.

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