

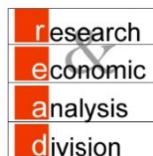
Hawaii Housing Demand: 2020-2030



Department of Business,
Economic Development & Tourism

Research and Economic Analysis Division

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This report is prepared by Drs. Binsheng Li, Jie Bai, and Wayne Liou, Economists, under the direction of Dr. Eugene Tian, Division Administrator.

I. Introduction

In March 2015, DBEDT released a report *Measuring Housing Demand in Hawaii, 2015-2025*. The study forecasted the statewide demand for residential housing was between 64,700 to 66,000 units for the 2015-2025 period. The housing demand projection was, in part, based on the long-range population projection in the DBEDT 2040 Series, which was released by DBEDT in 2012. The DBEDT 2040 Series population projection was based on the historical population trend up to 2010.

Since the release of the 2015 housing demand study, population growth has slowed. The DBEDT 2045 Series, the new long-range population projection released in June 2018, updates the historical population and economic trend up to 2016. The new release revised the long-term population projection downward for all the years up to 2040 and added the projection for 2045. Furthermore, according to the estimates by the U.S. Census Bureau, Hawaii lost resident population two years in a row in 2017 and 2018, for the first time since statehood.

Table 1 presents the differences between the DBEDT 2040 Series and DBEDT 2045 Series projections. For 2025, the new projection was 28,517 persons fewer than the previous projection, and 45,497 fewer for 2030. This revision alone could reduce the housing demand by 9,833 units (assuming the average household size is 2.9 persons) by 2025. In 2017 and 2018, the Hawaii resident population decreased by 7,614 for the two years, which represents a decrease of housing demand from the 2016 level of about 2,626 units (the previous projection for 2017 and 2018 was a demand of an additional 4,733 units from the 2016 level).

Table 1. DBEDT Long-Range Population Projections: 2020-2030

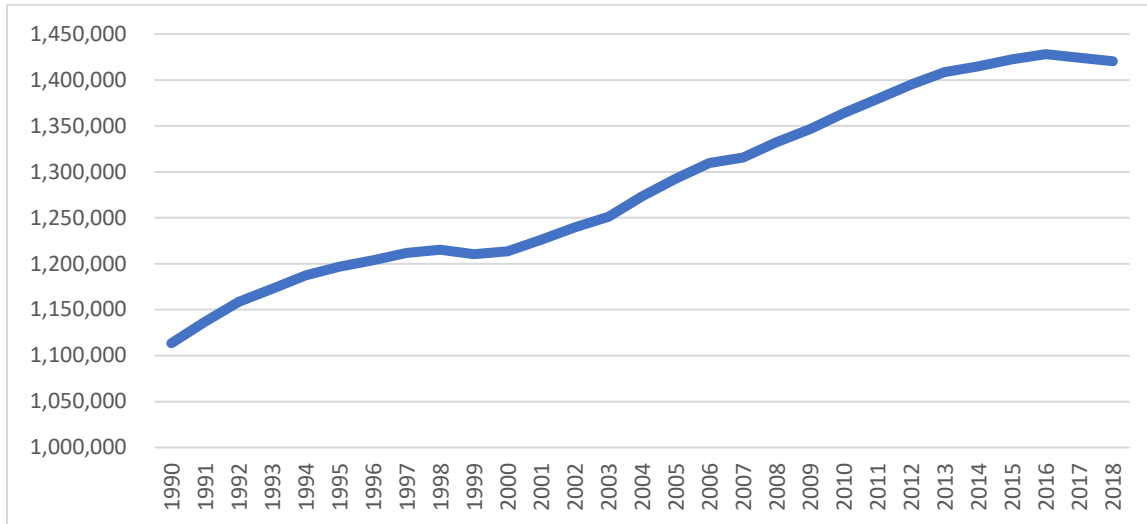
Series	2020	2025	2030
DBEDT 2040 Series	1,481,240	1,543,240	1,602,340
DBEDT 2045 Series	1,466,632	1,514,723	1,556,843
Difference	-14,608	-28,517	-45,497

DBEDT 2040 Series was based on population data of 2010 and release in 2012.

DBEDT 2045 Series was based on 2016 population data and released in June 2018.

Given the above developments, it is necessary to update the 2015 DBEDT housing demand projection using the most recent data and trends. This update revises the previous statewide housing demand from 6,470 a year (2015-2025) to 3,616 a year (2020-2030).

Figure 1. Hawaii Resident Population: 1990-2018



Population estimates are as of July 1 in the respective years.

II. Methods

Data from 1990 to 2018 from the U.S. Census Bureau were used in this projection. The projections were performed by the following steps:

1. Total housing units were broken down into four categories as depicted in Figure 2: Units for housing households (both owner-occupied and rental units), units vacant-for-sale, units vacant-for-rent, and units vacant for other use. Units for the use of households were the actual counts (from decennial census) and estimates (between census years) by the U.S. Census Bureau. The number of housing units used for households is equal to the number of households. Households were further divided into home owners and renters by applying the home ownership rates, which were also available from the U.S. Census Bureau. Units vacant-for-sale and units vacant-for-rent were then calculated using the formulae below:
 - (a) Home owner units = number of households \times homeownership rate
 - (b) Rental units = Number of households – home owner units
 - (c) Units vacant for sale = Home owner units \times vacant rate for home owners
 - (d) Units vacant for rental = Rental units \times vacant rate for renters
 - (e) Units vacant for other use = Total housing units – all of the above

Units for other use includes those sold but not yet occupied at the time of the survey (American Community Survey by the U.S. Census Bureau) and those used for seasonal, recreational, and occasional uses, mainly the second homes.

Figure 2. Representation of Categories for Total Housing Units

TOTAL HOUSING UNITS				
(a) Owner housing units (homeownership rate)			(b) Rental units	
(e) Vacant for other	(c) Vacant-for-sale (owner vacancy rate)	Owner occupied	Occupied rental	(d) Vacant-for-rental (rental vacancy rate)
		Number of households		

Not drawn to scale

2. Econometric models were used to forecast the state level housing units for 2019 and 2030. The projections were done in four categories: demand for household growth, vacant-for-sale demand, vacant-for-rent demand, and vacant for other demand.

The demand for household growth is based on population growth and the population to household ratio. Two different assumptions of population growth were used to create a range of population forecasts:

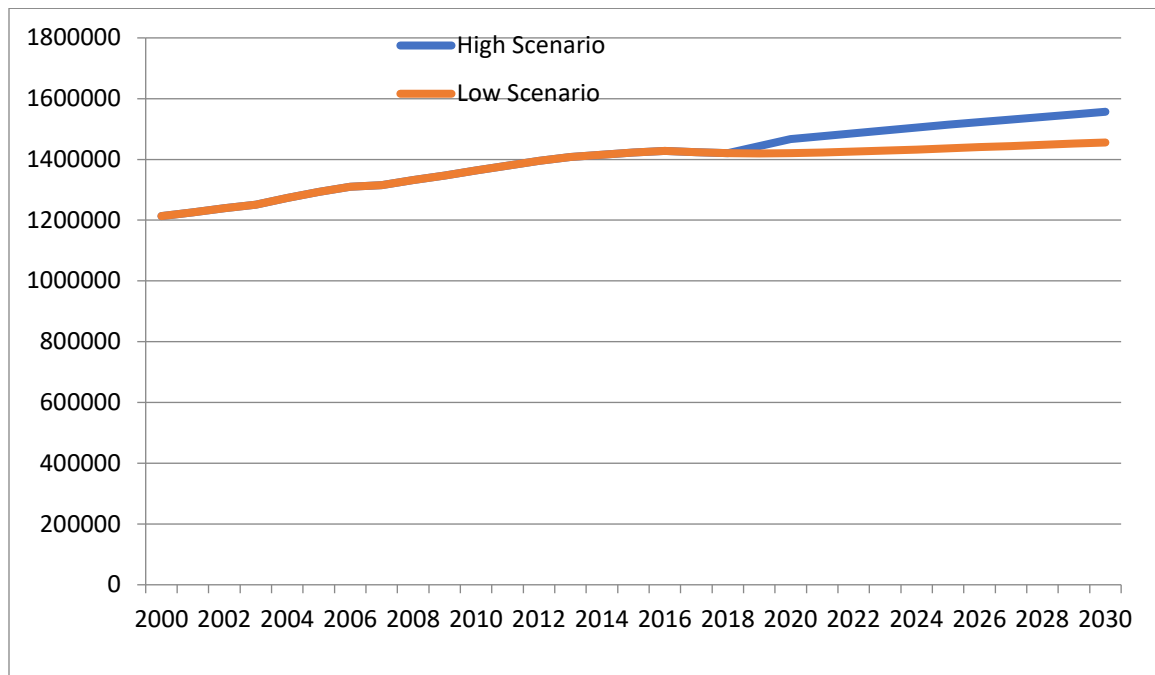
(1) Population growth in the future follows the trend of 1990-2016; the population declines in 2017 and 2018 are assumed to be outliers, and population growth will resume the same trend after 2018. Population projections under this assumption are similar to the DBEDT 2045 Series projections.

(2) Future population growth takes into account the 2017-2018 decline, which means that the future population growth will have a flatter trend from 1990-2016.

Figure 3 shows the population projections under the two different assumptions. Assumption (1) produced higher population growth (High Scenario). Assumption (2) produced lower population growth (Low Scenario).

Vacant-for-sale and vacant-for-rent projections were based on the projections of the household growth. Vacant for other unit was projected using historical trend of its own series. The econometric models are presented in Appendix A.

Figure 3. Population Growth Under High and Low Scenarios



- Statewide projections were then allocated to the counties by historical trends of the county shares of the four categories: units for households, vacant for sale, vacant for rent, and vacant for other.

III. Results

The forecast yielded a total resident population of 1,455,686 by 2030 under the assumption that future population growth will start a new trend which is influenced by the 2017-2018 population decline (Low Scenario). Under this scenario, population growth will be at an annual rate of 0.25 percent.

Under the assumption that population will continue to grow at the pre-2017 trend starting in 2019 (High Scenario), total population is projected to be 1,556,843 by 2030. This represents an annual average growth rate of 0.6 percent. As presented in Table 2, the average of the two scenarios is 0.43 percent annual population growth between 2020 and 2030.

Table 2. Population Forecast: 2020-2030

Period	Low Scenario	High Scenario	Average
2020	1,420,417	1,466,632	1,443,525
2030	1,455,686	1,556,843	1,506,265
Average annual growth	0.25%	0.60%	0.43%

Source: DBEDT, READ

Based on the projected population, the housing units needed is 25,737 units for the Low Scenario and 46,573 units for the High Scenario. The average of the two scenarios is a total of 36,155 units demanded for 2020-2030.

Table 3 shows the housing demand by category. In the average scenario, 65.3 percent (23,617 units) of the units demanded will be occupied by the additional households, 11.7 percent will be vacant units that are for sale or for rent, and 23.0 percent will be used as vacant for other use.

Table 3. Statewide Housing Demand in Hawaii: 2020-2030

Category	Low Scenario	High Scenario	Average	% of Total, Average
Total demand	25,737	46,573	36,155	100.0%
Demand for household growth	14,730	32,503	23,617	65.3%
Demand for vacant units	11,006	14,070	12,539	34.7%
Vacant For-Sale units	424	1,309	867	2.4%
Vacant For-Rent units	2,266	4,445	3,356	9.3%
Vacant for other units	8,316	8,316	8,316	23.0%

Source: DBEDT, READ

Table 4 presents the actual housing units by usage for 2018 and the projected units for 2020 and 2030. The difference between 2020 and 2030 are the additional units demanded (consumers want them and able to afford either for rent or purchase). The average annual growth of the housing units between 2020 and 2030 is projected to be 0.6 percent.

Table 4. Actual and Average Projection Results: 2018, 2020, and 2030

Category	2018	2020	2030	Additional units 2020-2030	Average annual growth 2020- 2030 (%)
Total housing units	546,213	554,334	590,498	36,155	0.6
Number of households	455,309	462,992	486,609	23,617	0.5
Vacant for-sale units	5,525	6,161	7,027	867	1.3
Vacant for-rent units	18,803	20,585	23,940	3,356	1.5
Vacant for other units	66,576	64,606	72,922	8,316	1.2
% share					
Housing units	100.0	100.0	100.0		
Number of households	83.4	83.5	82.4		
Vacant for-sale units	1.0	1.1	1.2		
Vacant for-rent units	3.4	3.7	4.1		
Vacant for other units	12.2	11.7	12.3		

Source: DBEDT, READ

Table 5 breaks the housing demand by county and by category based on historical shares and trends. As presented in Table 5, the vacant for other units will be heavier on the neighbor island counties. This is consistent with the home sales experienced during the last 10 years. Of the total residential homes sold between January 2008 and September 2019, 44.5 percent of the homes sold on the neighbor island counties were to out-of-state residents: 42.2 percent of homes sold in Hawaii County were to out-of-state residents, 48.0 percent in Maui County, and 42.9 percent in Kauai County. In contrast, only 14.7 percent of the home sold on Oahu were to non-residents during the same period. Many of the homes owned by non-residents were left vacant for most of the year, with the owner only staying during the holidays.

Table 5. Housing demand by County, by Type: 2020-2030

Category	State	Honolulu	Hawaii	Maui	Kauai
<i>Low Scenario</i>					
Total demand	25,737	10,402	7,816	5,563	1,955
Demand for household growth	14,730	7,950	4,051	1,932	798
Demand for vacant units	11,006	2,452	3,765	3,631	1,157
Vacant for-sale units	424	177	144	79	24
Vacant for-rent units	2,266	1,070	544	476	177
Vacant for other units	8,316	1,206	3,077	3,077	956
<i>High Scenario</i>					
Total demand	46,573	21,392	13,527	8,515	3,138
Demand for household growth	32,503	17,542	8,938	4,263	1,760
Demand for vacant units	14,070	3,850	4,589	4,252	1,378
Vacant for-sale Units	1,309	547	445	242	75
Vacant for-rent Units	4,445	2,098	1,067	933	347
Vacant for other units	8,316	1,206	3,077	3,077	956
<i>Average</i>					
Total demand	36,155	15,897	10,672	7,039	2,547
Demand for household growth	23,617	12,746	6,495	3,097	1,279
Demand for vacant units	12,538	3,151	4,177	3,942	1,268
Vacant for-sale units	867	362	295	160	50
Vacant for-rent units	3,356	1,584	805	705	262
Vacant for other units	8,316	1,206	3,077	3,077	956

Source: DBEDT, READ

Table 6 summarizes the results by county. Honolulu County will need as many as 21,392 units in the next 10 years if population growth follows the pre-2016 trend. If population growth slows down to 0.25 percent per year, then the demand for housing would be 10,402 units for the next 10 years. In the average of the two scenarios, 15,897 units will be needed over the next 10 years, accounting for 44.0 percent of the total state demand.

On average, Hawaii County will need about 10,672 units for the next 10 years, accounting for 29.5 percent of the state total. Maui County will need an average of 7,000 units, accounting for 19.5 percent of the state total. Kauai will need about 2,500 units between 2020-2030, accounting for 7.0 percent of the state total demand.

Table 6. Summary of Housing Demand by County: 2020-2030

County	Low Scenario	High Scenario	Average	% of Total, Average
State	25,737	46,573	36,155	100.0%
Honolulu County	10,402	21,392	15,897	44.0%
Hawaii County	7,816	13,527	10,672	29.5%
Maui County	5,563	8,515	7,039	19.5%
Kauai County	1,955	3,138	2,547	7.0%

Source: DBEDT, READ

Appendix A: Econometric Model Performance

Econometric models were used to forecast the state level housing units for 2019 through 2030. The projections were done in four categories: demand for household growth, vacant-for-sale demand, vacant-for-rent demand, and vacant for other use units.

1. The demand for household growth is based on the population growth and the population to household ratio. Model performance is shown below.

Dependent Variable: LOG(NHH)

Method: ARMA Conditional Least Squares (Gauss-Newton / Marquardt steps)

Sample (adjusted): 1991 2018

Included observations: 28 after adjustments

MA Backcast: 1990

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(RESPOP)	0.995315	0.009266	107.4141	0.0000
LOG(PHR)	-0.943083	0.116410	-8.101398	0.0000
AR(1)	-0.124431	0.447227	-0.278228	0.7832
MA(1)	0.549908	0.373888	1.470785	0.1543
R-squared	0.987882	Mean dependent var		12.94677
Adjusted R-squared	0.986367	S.D. dependent var		0.071020
S.E. of regression	0.008292	Akaike info criterion		-6.615420
Sum squared resid	0.001650	Schwarz criterion		-6.425105
Log likelihood	96.61589	Hannan-Quinn criter.		-6.557239
Durbin-Watson stat	2.007323			
Inverted AR Roots	-.12			
Inverted MA Roots	-.55			

Where

LOG(NHH): logarithm of the number of households

LOG(RESPOP): logarithm of resident population

LOG(PHR): the population to household ratio

AR(1): the first-order autoregressive process

MA(1): the first-order moving average process

The population to household ratio is projected based on the model below:

Dependent Variable: LOG(PHR)

Method: ARMA Conditional Least Squares (Marquardt - EViews legacy)

Sample (adjusted): 1992 2018

Included observations: 27 after adjustments

MA Backcast: 1991

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	1.121583	0.022545	49.74856	0.0000
AR(2)	0.844518	0.119691	7.055802	0.0000
MA(1)	0.953772	0.046547	20.49044	0.0000
R-squared	0.789118	Mean dependent var		1.118928
Adjusted R-squared	0.771545	S.D. dependent var		0.019331
S.E. of regression	0.009240	Akaike info criterion		-6.426160
Sum squared resid	0.002049	Schwarz criterion		-6.282178
Log likelihood	89.75316	Hannan-Quinn criter.		-6.383346
F-statistic	44.90396	Durbin-Watson stat		2.197113
Prob(F-statistic)	0.000000			
Inverted AR Roots	.92	-.92		
Inverted MA Roots	-.95			

Where

LOG(PHR): the population to household ratio

AR(2): the second-order autoregressive process

MA(1): the first-order moving average process

2. Vacant for-sale and vacant for-rent projections were based on the projections of the household growth.

- Vacant for-sale Projections:

Dependent Variable: VFS

Method: ARMA Conditional Least Squares (Gauss-Newton / Marquardt steps)

Sample (adjusted): 1992 2018

Included observations: 27 after adjustments

MA Backcast: 1991

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-17188.06	5310.061	-3.236886	0.0038
NHH	0.049779	0.012132	4.103019	0.0005
AR(1)	1.239203	0.152944	8.102331	0.0000
AR(2)	-0.462547	0.147346	-3.139191	0.0048
MA(1)	-0.965434	0.027163	-35.54240	0.0000
R-squared	0.651285	Mean dependent var		4356.852
Adjusted R-squared	0.587882	S.D. dependent var		1416.462
S.E. of regression	909.3177	Akaike info criterion		16.62884
Sum squared resid	18190890	Schwarz criterion		16.86881
Log likelihood	-219.4894	Hannan-Quinn criter.		16.70020
F-statistic	10.27219	Durbin-Watson stat		1.991020
Prob(F-statistic)	0.000076			
Inverted AR Roots	.62+ .28i	.62- .28i		
Inverted MA Roots	.97			

Where

VFS: the number of vacant for-sale units

NHH: the number of households

AR(1) and AR(2): the first-order and second-order autoregressive process

MA(1): the first-order moving average process

- Vacant for-rent Projections:

Dependent Variable: VFR

Method: ARMA Conditional Least Squares (Gauss-Newton / Marquardt steps)

Sample (adjusted): 1991 2018

Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-35696.04	17444.00	-2.046322	0.0514
NHH	0.122560	0.040767	3.006389	0.0059
AR(1)	0.596372	0.164299	3.629794	0.0013
R-squared	0.679859	Mean dependent var		16091.96
Adjusted R-squared	0.654247	S.D. dependent var		4087.186
S.E. of regression	2403.295	Akaike info criterion		18.50803
Sum squared resid	1.44E+08	Schwarz criterion		18.65076
Log likelihood	-256.1124	Hannan-Quinn criter.		18.55166
F-statistic	26.54526	Durbin-Watson stat		1.916733
Prob(F-statistic)	0.000001			
Inverted AR Roots	.60			

Where

VFR: the number of vacant for-rent units

NHH: the number of households

AR(1): the first-order autoregressive process

3. Vacant for other units were projected using historical trend of its own series.

Dependent Variable: VOT

Method: ARMA Conditional Least Squares (Gauss-Newton / Marquardt steps)

Sample (adjusted): 1991 2018

Included observations: 28 after adjustments

MA Backcast: 1989 1990

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	91736.26	37305.65	2.459044	0.0215
AR(1)	0.964057	0.027911	34.54019	0.0000
MA(1)	-0.605702	0.206080	-2.939156	0.0072
MA(2)	-0.329019	0.197302	-1.667585	0.1084
R-squared	0.895010	Mean dependent var		40665.00
Adjusted R-squared	0.881886	S.D. dependent var		15808.32
S.E. of regression	5432.957	Akaike info criterion		20.16992
Sum squared resid	7.08E+08	Schwarz criterion		20.36023
Log likelihood	-278.3789	Hannan-Quinn criter.		20.22810
F-statistic	68.19760	Durbin-Watson stat		1.962306
Prob(F-statistic)	0.000000			
Inverted AR Roots	.96			
Inverted MA Roots	.95	-.35		

Where

VOT: the number of vacant for other units

AR(1): the first-order autoregressive process

MA(1) and MA(2): the first-order and second-order moving average process

Appendix B: Historical Data

Year	Resident Population	Number of Housing Units	Number of Household	Population to Household Ratio	Rental Vacancy Rate	Vacant Rental Units	Owner Vacancy Rate	Vacant for Sale Units	Vacant for Other Units
1990	1,113,491	389,811	356,268	3.1	6.6	11,449	0.8	1,731	20,363
1991	1,136,754	399,642	366,446	3.1	5.8	10,384	1.4	3,088	19,723
1992	1,158,613	407,219	375,018	3.1	5.8	10,912	2.5	5,477	15,812
1993	1,172,838	412,652	378,068	3.1	6.8	13,244	3.0	6,536	14,803
1994	1,187,536	419,439	381,119	3.1	7.4	14,805	2.0	4,387	19,127
1995	1,196,854	426,345	386,318	3.1	6.3	13,376	2.0	4,281	22,370
1996	1,203,755	433,039	391,202	3.1	6.0	12,835	1.4	3,068	25,934
1997	1,211,640	436,602	396,008	3.1	7.1	15,437	1.6	3,507	21,650
1998	1,215,233	440,044	400,927	3.0	6.9	14,331	1.3	3,020	21,765
1999	1,210,300	450,845	402,084	3.0	7.6	14,871	1.8	4,593	29,298
2000	1,213,519	461,646	403,240	3.0	5.3	10,961	0.9	2,293	45,151
2001	1,225,948	466,175	411,647	3.0	8.2	17,011	0.8	2,070	35,447
2002	1,239,613	470,601	415,479	3.0	7.3	14,463	0.9	2,452	38,207
2003	1,251,154	476,104	419,441	3.0	8.9	17,670	1.2	3,331	35,663
2004	1,273,569	482,971	427,673	3.0	7.7	14,652	1.3	3,805	36,841
2005	1,292,729	491,559	430,007	3.0	5.1	10,078	0.6	1,764	49,710
2006	1,309,731	500,837	432,632	3.0	5.5	11,046	1.0	3,000	54,159
2007	1,315,675	507,743	439,685	3.0	6.3	12,763	1.7	5,188	50,107
2008	1,332,213	514,132	437,105	3.0	7.2	15,140	1.7	5,165	56,721
2009	1,346,717	517,829	446,136	3.0	9.2	19,294	1.9	5,854	46,545
2010	1,363,963	520,088	445,812	3.1	8.1	18,494	1.9	5,544	50,239
2011	1,379,252	523,213	448,536	3.1	9.4	21,935	2.2	6,377	46,365
2012	1,394,905	525,678	447,748	3.1	10.2	22,949	2.3	6,916	48,065
2013	1,408,453	528,390	450,120	3.1	10.1	22,788	1.8	5,450	50,032
2014	1,414,862	531,962	450,769	3.1	8.3	18,368	1.6	4,971	57,855
2015	1,422,484	534,727	445,936	3.2	8.7	18,934	1.5	4,756	65,100
2016	1,428,105	539,784	455,868	3.1	10.6	24,204	1.4	4,361	55,353
2017	1,424,203	542,853	458,078	3.1	8.7	20,830	1.3	3,945	60,002
2018	1,420,491	546,213	455,309	3.1	8.5	18,803	1.7	5,525	66,576

Source: U.S. Census Bureau, calculations by DBEDT.