Kem C. Gardner
POLICY INSTITUTE
THE UNIVERSITY OF UTAH

Gardner Industry Trends Model

By: Michael Hogue | Kem C. Gardner Policy Institute

The Gardner Industry Trends Model (GITM) produces statewide long-term employment projections by major industry. These employment projections serve as drivers for the Kem C. Gardner Policy Institute's (GPI) long-term demographic projections.

The first part of this document provides a basic overview of the process by which the 2017 GITM projections are derived. Subsequent pages show projected statewide employment trends for the years 2016 through 2065. Each page provides details for a particular industry (sector), with 23 sectors included. The information provided includes a brief description of the sector, historical and projected employment (jobs), absolute and relative rates of employment growth, average rates of growth, and commentary. Data files of both the employment and demographic projections are available from the GPI website.

GITM Objective and Methods

GITM translates a given set of national employment projections by industry into a corresponding set of Utah employment projections by industry. An advantage of using credible national employment projections as drivers is that "big picture" thinking on future trends in retail, healthcare, and other industries are incorporated into the Utah projections.

The projections of GITM are, as the name suggests, best considered as projections of trend employment. The reason for this is that the national employment projections on which GITM are based are trend projections. Trend employment does not include employment due to the business cycle — for example, economic expansions or recessions. Consequently, GITM projections will tend to be too high during periods of recession and too low during periods of economic expansion. For this reason, GITM projections are most appropriate as long-term, trend, projections.

GITM projections are created in two basic steps. First, historical relationships between Utah employment and national employment are ascertained and projected into the future. Utah employment is then calculated by applying independently projected national employment to each projected Utah-U.S. relationship. GITM considers six Utah-U.S. relationships, yielding six projections, for each sector. Because combinations of projections often perform better than individual projections, the average and median projection (computed among the basic six projections) is also included. A detailed discussion of the relationships is given in a subsequent section.

Projected national employment is obtained from a vendor for the years 2016–2047 and extrapolated by GPI for the years 2048–2065. Further details on the national projections and the method used to extrapolate those projections are provided in a subsequent section.†

Employment Concept and Data Sources

The employment definition, or "concept" used in GITM includes civilian jobs that are subject to the state's unemployment insurance program ("covered employment"). It does not include the self-employed. Civilian public employment is collected into two sectors ("Federal Government" and "State and Local Government"); figures provided for other sectors refer to private-sector employment only. This measure of employment is consistent with employment data published by the Utah Department of Workforce Services.

GITM uses historical Utah and national employment by industry, and projected national employment by industry. The historical Utah data is obtained from the Utah Department of Workforce Services, while the historical and projected national data is obtained from IHS Global Insight (GI).

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GITM provides projections for the following sectors:

- Agriculture
- Mining
- Utilities
- Construction
- Manufacturing
- Wholesale
- Trade
- Retail Trade
- Transportation and Warehousing
- Information
- Finance and Insurance
- Real Estate
- Professional and Technical Services
- Management of Companies and Enterprises
- Administrative and Waste Services
- Educational Services
- Health Care
- Arts, Entertainment and Recreation
- Accommodations and Food Service
- Other Services
- Federal Government
- State and Local Government
- Farm†
- Military†

Further Details on Methods

The projections labeled in the following graphs and tables ("Growth," "Growth Rate," etc.) correspond to the different Utah-U.S. relationships. Each relationship is defined below in a section with matching a name. The "CAAGR" referenced in the tables stands for the compounded annual average growth rate—a summary measure of employment growth over a given period of time.

Relating Utah's Employment to National Employment

The historical relationships between Utah and national employment are captured by a set of simple models that can be seen as representing different perspectives on how Utah's employment moves relative to national employment. Each model yields a unique path of projected employment. An alternative to choosing any one model as "best" is to project employment from each model, then combine the results into a single projection. We do this using two combination methods: the mean and the median. A reference projection is also provided that shows what Utah's employment growth would look like if it grew at the same rate as the nation. Altogether, there are nine projections: six based directly on models, mean and median projections, and the reference projection.

For each industry, the GPI Executive Team, in consultation with the Utah Department of Workforce Services, selected one projection from among the eight non-reference projections (six basic projections plus the mean and the median) to serve as the published projection for that industry. In the graphs that follow, this selected projection is marked with dots; in the corresponding tables, it is marked with a red star. For 10 out of 23 industries, the selected GPI projection is either the mean or median projection.

The six models, discussed below, are special cases of the model:

$$Y_t = \alpha + \delta\,t + \beta\,X_t + u_t \qquad (1)$$

where Y_t concerns Utah employment (number of jobs, job growth, percentage job growth) in year t, X_t concerns U.S. employment (number of jobs, job growth, percentage job growth) in year t, α is a constant, $\delta\,t$ is a linear time trend ("drift"), β is the "effect" of a one-unit change in U.S. employment on the expected change in Utah employment, and u_t is the net effect on Utah employment of all factors other than these, called the "disturbance term." The all-else-equal interpretation of β given above is strictly valid only if the average value of u_t is independent of U.S. employment. Such an interpretation is convenient here, but not necessary for the forecasting purpose of GITM.

Each of the six models is a variation on the above equation and represents a specific relationship between a Utah employment variable and its U.S. counterpart. These models and their practical interpretations are reviewed one by one in the sections below. The section titles serve as labels and are referenced in the pages that follow. For example, page 12 shows employment projections for the "Transportation and Warehousing" sector, where a line overlaid with dots is labeled "Growth with Drift." This line represents the projection made with the model described under the section below of the same name. The dots mark that projection as the one chosen by the GPI Executive Team to be the published statewide projection for this sector.

Growth. The Growth model implies that expected Utah employment growth in the current year is a multiple (β) of U.S. employment growth in the same year.

$$Y_t = \alpha + \beta\,X_t + u_t$$

In this equation Y_t is Utah employment (number of jobs) in year t and X_t is U.S. employment in the same year. For example, if $\beta = 0.02$ and U.S. employment growth in year t is 2,500,000 jobs then, according to this model, expected Utah employment growth is $0.02 \times 2{,}500{,}000 = 50{,}000$ jobs in year t.

Change in Growth. The Change in Growth model implies that the expected change in Utah employment growth from last year to the current year is a multiple of the change in U.S. employment growth from last year to the current year.

$$Y_t - Y_{t-1} = \alpha + \beta\left(X_t - X_{t-1}\right) + u_t$$

For example, if $\beta = 0.02$ and U.S. employment growth changes from 2,500,000 per year to 2,550,000 per year then, according to this model, the expected increase in Utah's employment growth is $0.02 \times (2{,}550{,}000 - 2{,}500{,}000) = 1{,}000$. If Utah's employment growth had been 50,000 jobs in the

previous year, then the expected growth in the current year would be $51{,}000$ jobs.

Growth with Drift. The Growth with Drift model is similar to the Growth model but allows Utah's expected employment growth to vary by an amount δ from what would be expected given U.S. employment growth alone.

$$Y_t = \alpha + \delta\, t + \beta\, X_t + u_t$$

For example, if $\beta = 0.02$ and $\delta = 5{,}000$, and U.S. employment growth this year is $2{,}500{,}000$ jobs then, according to this model, expected Utah employment growth this year is $0.02 \times 2{,}500{,}000 + 5{,}000 = 55{,}000$ jobs.

Change in Growth with Drift. The Change in Growth with Drift model is similar to the Change in Growth model but allows Utah's expected change in employment growth to vary by an amount δ from what would be expected given the change in U.S. employment growth alone.

$$Y_t - Y_{t-1} = \alpha + \delta\, t + \beta\left(X_t - X_{t-1}\right) + u_t$$

For example, if $\beta = 0.02$ and $\delta = 50$, and U.S. employment growth changes from $2{,}500{,}000$ to $2{,}550{,}000$ from last year to this year then, according to this model, Utah's expected employment growth will increase by $50 \times 1 + 0.02 \times (2{,}550{,}000 - 2{,}500{,}000) = 50 + 1{,}000 = 1{,}050$ jobs. If Utah's employment growth had been $50{,}000$ jobs in the previous year, then the expected growth in the current year would be $51{,}050$ jobs.

Growth Rate. The Growth Rate model is similar to the Growth model but concerns percentage employment growth rather than absolute employment growth.

$$\log Y_t = \alpha + \beta \log X_t + u_t$$

For example, if $\beta = 1.2$ and the U.S. employment growth rate is 1.5% then, according to this model, Utah's expected employment growth rate is $1.2 \times 1.5\% = 1.8\%$.

A brief word is in order for the natural logarithm that appears here and below; in particular its connection to percentage change. The connection hinges on the fact that, for values of x close to 1, $\log x$ is close to $x - 1$. If Δx is a small change in x (such as the change in employment from one year to the next), then the ratio $(x + \Delta x)/x$ will be close to 1. Therefore, $\log((x + \Delta x)/x)$ will be close to $(x + \Delta x)/x - 1$. Using the properties of logarithms, this can be rephrased as $\log(x + \Delta x) - \log x$ will be close to $\Delta x / x$ — the proportional change in x (100 times this will be the percentage change in x).

Change in Growth Rate. The Change in Growth Rate model is similar to the Change in Growth model but concerns the change in percentage employment growth rather than the change in absolute growth.

$$\log Y_t - \log Y_{t-1} = \alpha + \beta\left(\log X_t - \log X_{t-1}\right) + u_t$$

For example, if $\beta = 1.2$ and U.S. employment growth increases from 1.5% to 2.0% then, according to this model, the expected change in Utah's employment growth rate is $1.2 \times 0.5\% = 0.6\%$. If Utah's employment growth rate had been 1.8% in the previous year, then the expected growth rate in the current year would increase to 2.4%.

Moving from the Short Run to the Long Run. Economic time series very often exhibit the feature that observations close in time tend to be close in value. Many of the employment series found on subsequent pages show this kind of "tracking" behavior. This section describes an adjustment procedure that accommodates tracking behavior in u_t. An important consequence of applying this procedure is that GITM projections adjust toward, rather than jump to, the long-run behavior described above. Practically, this means that there is a much smoother transition between historical employment and projected employment than would have been the case without the adjustment. This is important since the demographic model that takes GITM projections as input works best with smooth inputs.

To describe the adjustment, start with the basic model (1) from above,

$$Y_t = \alpha + \delta\, t + \beta\, X_t + u_t$$

and model u_t with the following tracking behavior: $u_t = \phi\, u_{t-1} + \varepsilon_t$, where ε_t is a disturbance term without tracking and $|\phi| < 1$. The following sequence shows that by transforming each variable and (implicitly) u_t by $f(\phi) = 1 - \phi$, a model is obtained in which the disturbance does not track.

$$
\begin{aligned}
Y_{t-1} &= \alpha + \delta\,(t-1) + \beta\, X_{t-1} + u_{t-1} \\
\phi\, Y_{t-1} &= \phi\,\alpha + \phi\,\delta\,(t-1) + \phi\,\beta\, X_{t-1} + \phi\, u_{t-1} \\
Y_t - \phi\, Y_{t-1} &= \alpha\left(1 - \phi\right) + \delta\left(t - \phi\,(t-1)\right) + \\
&\quad \beta\left(X_t - \phi\, X_{t-1}\right) + \varepsilon_t
\end{aligned}
\tag{2}
$$

By substituting $\tilde{\alpha} = \alpha\left(1 - \phi\right)$, $\tilde{t} = \delta\left(t - \phi\,(t-1)\right)$, and $\tilde{X} = \beta\left(X_t - \phi\, X_{t-1}\right)$, the last line can be written as: $Y_t = \phi\, Y_{t-1} + \tilde{\alpha} + \delta\,\tilde{t} + \beta\,\tilde{X}_t + \varepsilon_t$, which shows that expected Utah employment "this year," given national employment, t, and Utah employment "last year," is a function of Utah employment "last year." This also shows that the degree of tracking depends on the value of ϕ, with values closer to one implying that the part of Utah employment not predictable from national employment and time can remain away from long-run equilibrium for some time. On the other hand, values of ϕ close to 0 indicate that convergence to the long-run equilibrium is immediate, so that no adjustment is necessary.

If we knew ϕ, then α, δ, and β could be estimated using ordinary least squares on (2) and the adjustment applied.

In almost all applications, including ours, ϕ is unknown and must be estimated from data. There are several ways to do this. Our estimates of ϕ are based on the method of maximum likelihood.

National Projections

The current version of GITM uses GI Trend national projections, of 2017 Q1 vintage. Unfortunately, these 30-year projections only extend to 2047, while GITM projections must reach to 2065. We solve this problem simply by extrapolating GI growth rates from 2048 through 2065, then applying those growth rates to GI 2047 job counts.

The method used to extrapolate growth rates meets two goals: to capture and continue the trend in GI growth rates over the period 2011–2047 and to minimize "jump" at the point of transition between the GI projections and the extrapolated projections. To accomplish this, the exponential curve $f(t) = \alpha e^{-\beta t}$ is used, where α is the growth rate in the initial year and β is the annual proportional change in the growth rate. Given the conditions $f(0) = r_0$ and $f(S) = r_S$, where r_0 is the growth rate in the initial year (0, corresponding to 2016) and r_S is the growth rate in the final year available from GI (S, corresponding to 2047), these parameters are determined as $\alpha = r_0$ and $\beta = \frac{\log(r_S/r_0)}{S}$, so that the curve interpolating the growth rates in 2016 and 2047 is given by $f(t) = r_0 e^{\frac{-\log(r_S/r_0)}{S} t}$. Figure 1 illustrates for the case of Retail Trade. The years before the first red dot are historical, the years between the first and second red dots, labeled "Available," are years where GI-projected growth rates are provided by GI, and the years after the second red dot, labeled "Extrapolated," are years where growth rates are not provided by GI and are extrapolated using the approach described above. The curve connecting the two dots provides the extrapolated growth rates for the years 2048–2065 (the original GI growth rates are retained for the years where they are available, 2016–2047). The growth rates that serve as input to GITM are represented by the solid line.

The results can be inspected by looking at the "reference" projections in the following graphs. The method appears to work well for most cases. One case where it arguably does not work well is Construction. The case of Construction is troublesome because the 2016 growth rate is only slightly greater than the 2047 growth rate, resulting in a rather flat exponential curve and, consequently, extrapolated growth rates that decline only very slowly. The result of these almost-constant growth rates is that for the years 2048–2065 extrapolated/projected national employment growth in the Construction industry is almost exponential. GITM translates this result into a similar pattern for Utah.

Figure 1: Extrapolating National Retail Trade Employment Growth Rates
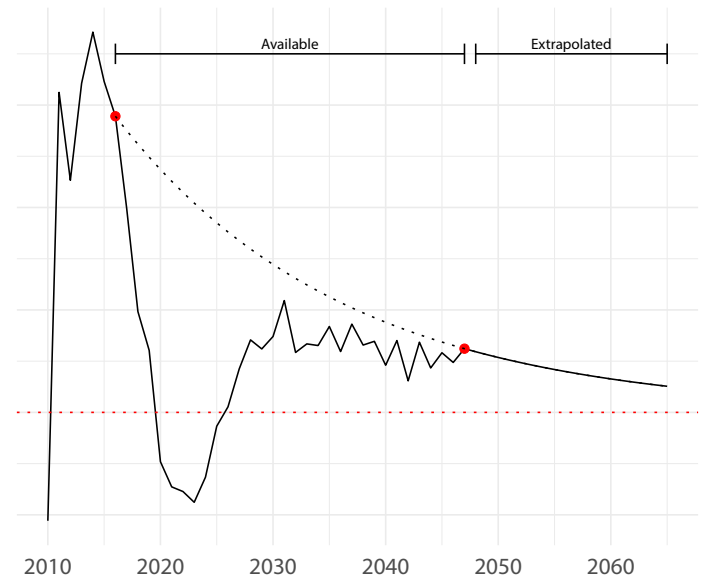
Summary Measures of Growth

On the pages that follow we present graphs showing projected employment by industry. One useful way of summarizing such growth over time in a single number is the compounded average annual growth rate (CAAGR), which is also shown for each projection. The CAAGR shows the annual rate of growth sufficient to carry employment from its base-year (2015) value to its terminal-year (2065) value. For example, if base-year employment is 1,000, terminal-year employment is 2,000, and the terminal year is 50 years after the base year, then the CAAGR turns out to be 1.4%, meaning: If employment starts at 1,000 and each year grows by 1.4%, then at the end of 50 years employment will be 2,000.

To be clear about the calculation, if x_{2015} and x_{2065} represent employment in years 2015 and 2065, then the CAAGR of employment between those years is computed as $(x_{2065}/x_{2015})^{1/(2065-2015)} - 1$.

The CAAGR is not the same as the average of the annual growth rates, sometimes called the "usual," or "arithmetic" average (AAGR). While the AAGR is an appropriate answer to the question — "What is a typical year-over-year growth rate between 2015 and 2065?" — the CAAGR is appropriate for the question — "What rate of growth, if compounded each year, would carry employment from its base-year to terminal-year value?" The answers to these questions are different unless the growth rates are constant. Further, the AAGR generally exceeds the CAAGR, with a larger difference the more volatile the growth rates.
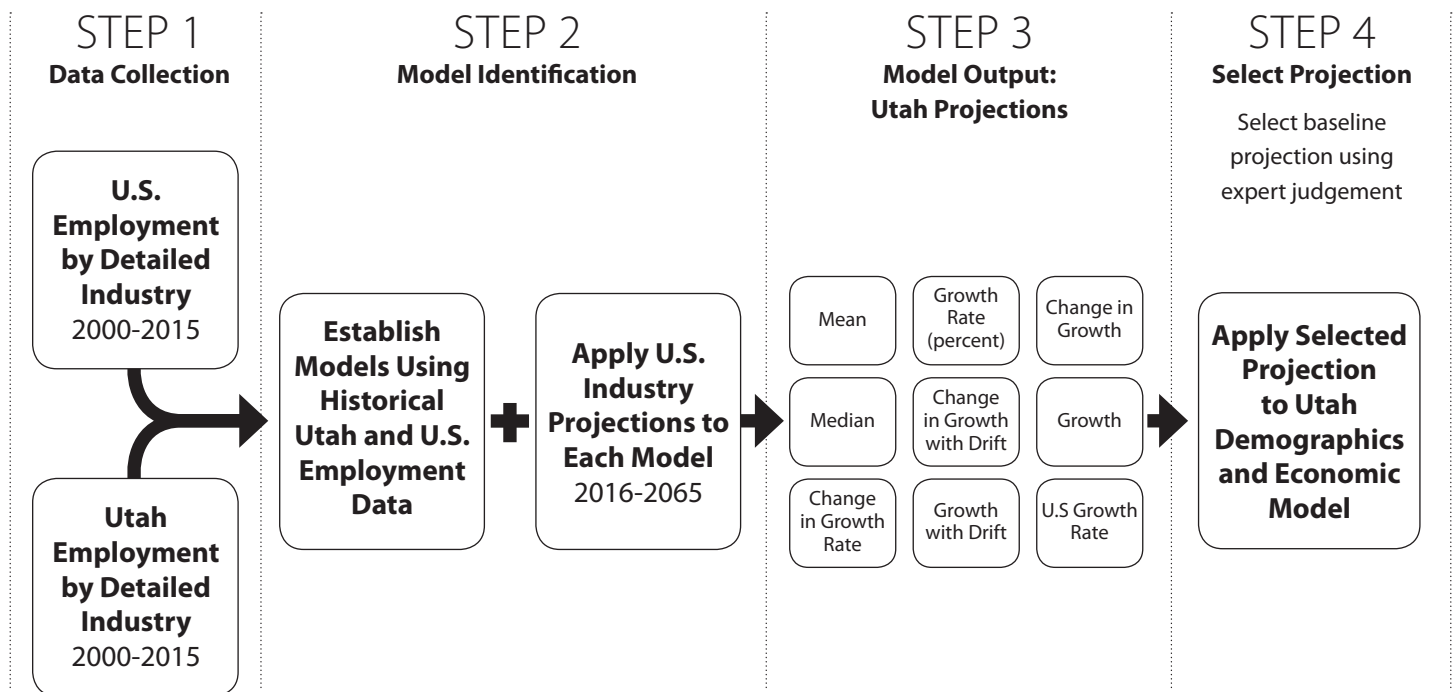
Endnotes

†The data and methods described in this report largely pertain to the civilian nonfarm industries: the 21 of 23 industries that exclude Farm and Military. Farm and Military employment are handled somewhat differently. For these two industries, Regional Economic Models Inc. (REMI), rather than Global Insight, serves as the provider of historical Utah and U.S. data, as well as projected U.S. employment. The REMI projections span the years 2016–2060 and are extrapolated by KCGPI for the years 2061–2065. The historical portion of the REMI projections ends in 2014; 2015 is projected. With subsequent BEA revisions to the 2014 data, there are now sizable differences between current BEA 2014 and 2015 estimates and the estimates of Military employment shown in this report.

Trends Model

The Kem C. Gardner Policy Institute uses the Gardner Industry Trend Model as the employment driver for our long-term demographic and economic projections. The model establishes the historical relationship between U.S. and Utah employment for 23 detailed industries and then utilizes expert judgment to choose between nine models (six original, two combinations of these six, and one serving as reference) to arrive at 50-year employment projections. These projections combine with the Utah Demographic and Employment Model (UDEM) to produce population and employment projections for Utah.

Model Logic

STEP 1	STEP 2	STEP 3	STEP 4
Data Collection	**Model Identification**	**Model Output: Utah Projections**	**Select Projection**
			Select baseline projection using expert judgement

STEP 1 — Data Collection

U.S. Employment by Detailed Industry 2000-2015

Utah Employment by Detailed Industry 2000-2015

STEP 2 — Model Identification

Establish Models Using Historical Utah and U.S. Employment Data

+

Apply U.S. Industry Projections to Each Model 2016-2065

STEP 3 — Model Output: Utah Projections

Mean	Growth Rate (percent)	Change in Growth
Median	Change in Growth with Drift	Growth
Change in Growth Rate	Growth with Drift	U.S Growth Rate

STEP 4 — Select Projection

Apply Selected Projection to Utah Demographics and Economic Model

Notes:
1. U.S. employment history and projections by detailed industry provided by HIS Global Insight.
2. Utah employment by detailed industry provided by the Utah Department of Workforce Services.
3. The U.S. Industry Projections data is added into the calculation after establishing models using the combined historical Utah-U.S. employment by detailed industry.
4. Extrapolations of U.S. employment by detailed industry (2048-2065) calculated by the Kem C. Gardner Policy Institute.
5. "Growth" models statistically evaluate changes in the number of jobs, while "Growth Rate" models statistically evaluate percentage changes in the number of jobs. Models without "drift" estimate a historical relationship between Utah and the U.S. and project that fixed relationship into the future. Models with "drift" allow for the possibility that Utah employment patterns can become more, or less, similar to those of the U.S. over time. The speed of convergence, or divergence, is estimated from historical Utah/U.S. employment data.

Source: Kem C. Gardner Policy Institute

Projected Employment and Employment Growth 2016–2065
Agriculture, Forestry, Fishing and Hunting

Employment
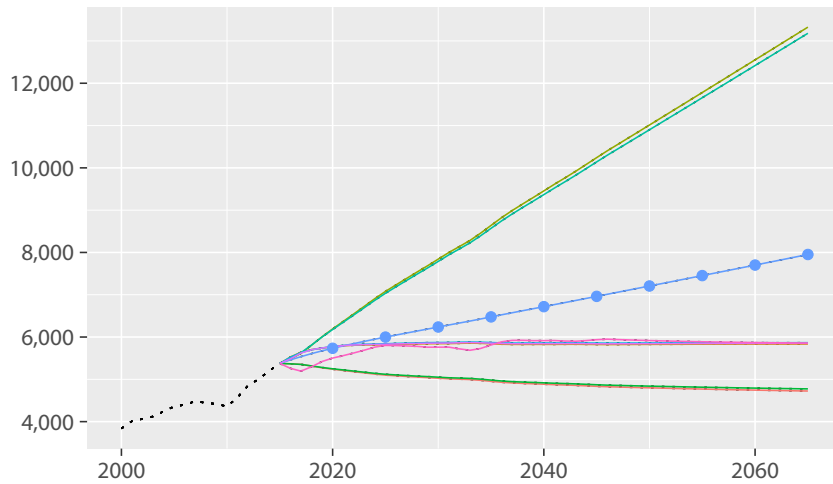
Employment Growth
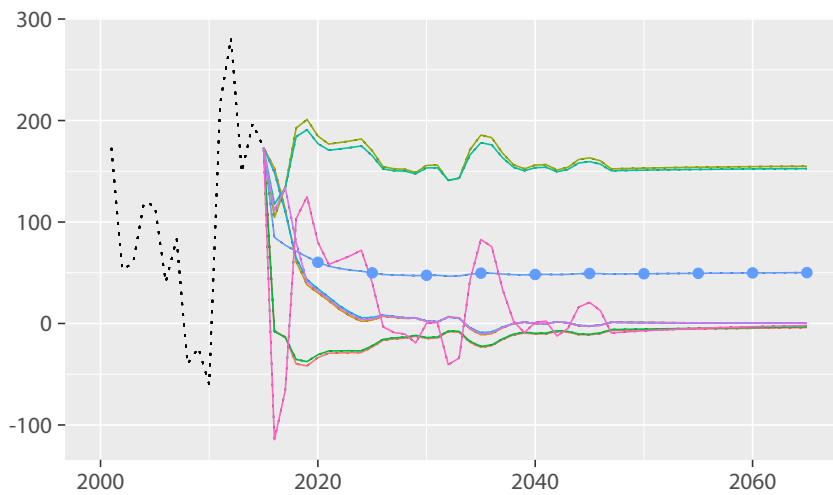
Employment Growth Rates
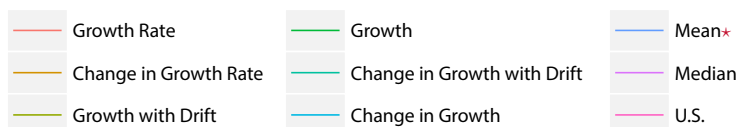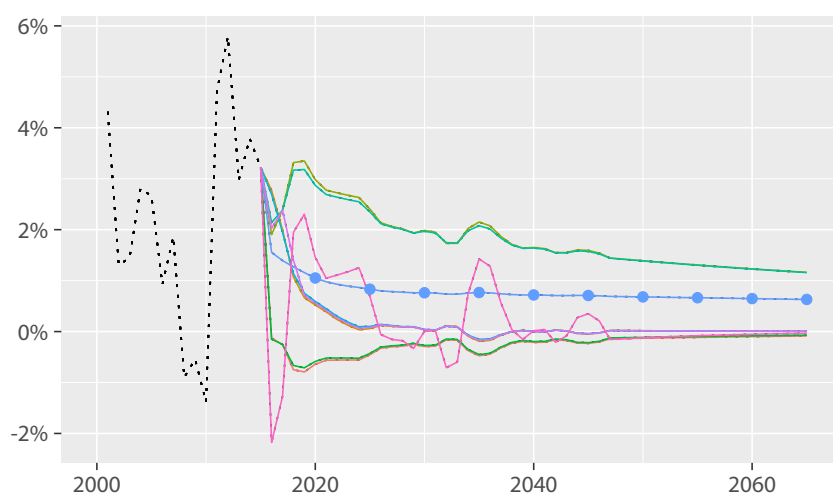
Industry Description According to the U.S. Census Bureau, "Activities of this sector are growing crops, raising animals, harvesting timber, and harvesting fish and other animals from farms, ranches, or the animals' natural habitats."
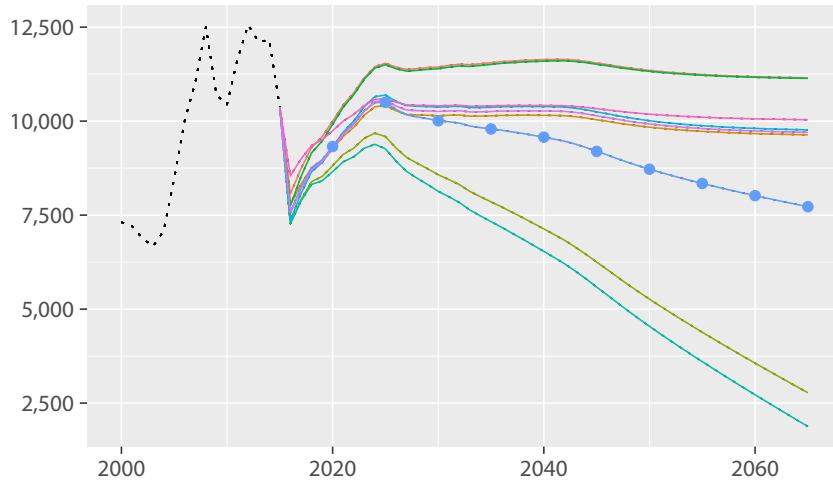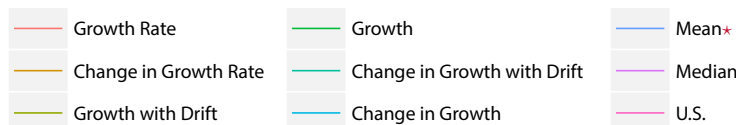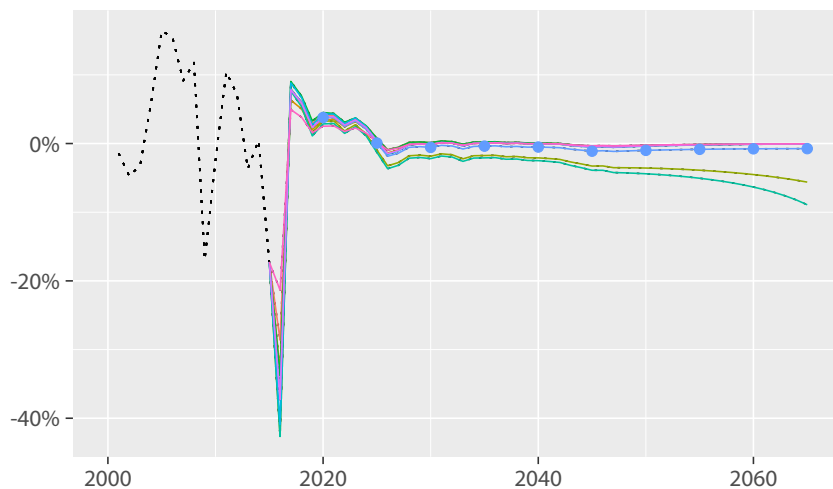
About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, and a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S. The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case the Mean, is marked with dots in the graphs and a star in the legend and table.

	CAAGR %
2000–2015	
2000–2015	2.27
2016–2030	
Growth Rate	-0.47
Change in Growth Rate	0.40
Growth with Drift	2.59
Growth	-0.43
Change in Growth with Drift	2.53
Change in Growth	0.44
Mean ★	0.96
Median	0.47
U.S.	0.65
2016–2065	
Growth Rate	-0.26
Change in Growth Rate	0.11
Growth with Drift	1.83
Growth	-0.24
Change in Growth with Drift	1.80
Change in Growth	0.12
Mean ★	0.77
Median	0.13
U.S.	0.22

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift
- Change in Growth
- Mean ★
- Median
- U.S.

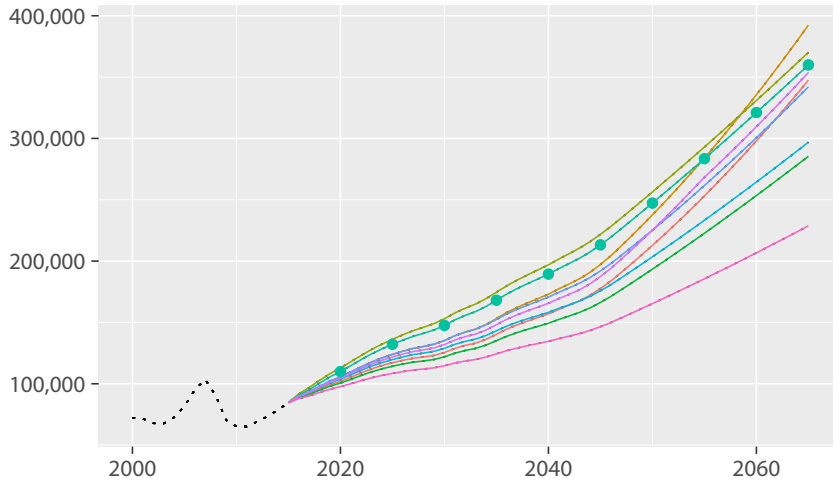# Projected Employment and Employment Growth 2016–2065
## Mining, quarrying, and oil and gas extraction

Employment
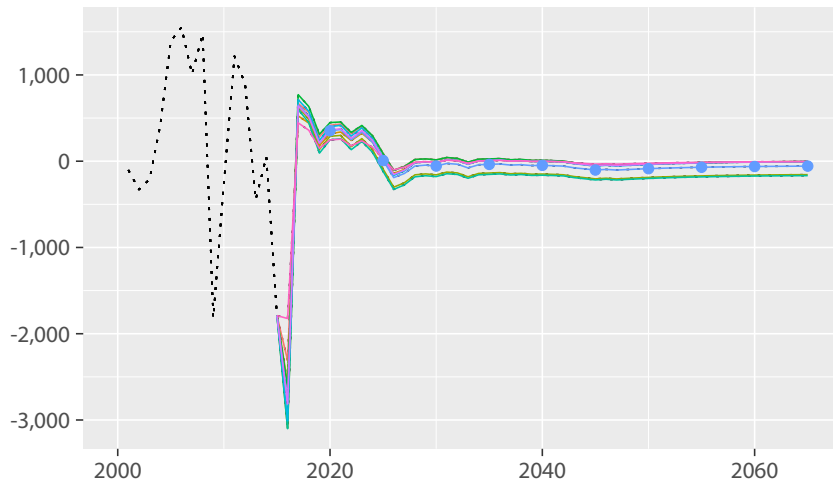
Employment Growth

Employment Growth Rates

	Growth Rate		Growth		Mean ⋆
	Change in Growth Rate		Change in Growth with Drift		Median
	Growth with Drift		Change in Growth		U.S.

Industry Description According to the U.S. Census Bureau, "Activities of this sector are extracting naturally occurring mineral solids, such as coal and ore; liquid minerals, such as crude petroleum; and gases, such as natural gas; and beneficiating (e.g., crushing, screening, washing, and flotation) and other preparation at the mine site, or as part of mining activity."
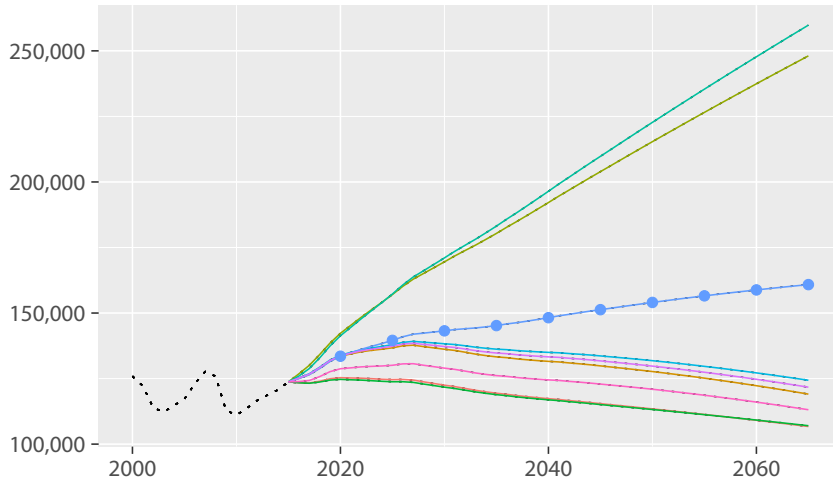
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	CAAGR %
2000–2015	
2000–2015	2.36
2016–2030	
Growth Rate	2.53
Change in Growth Rate	1.90
Growth with Drift	1.18
Growth	2.79
Change in Growth with Drift	0.81
Change in Growth	2.48
Mean ⋆	2.00
Median	2.21
U.S.	1.42
2016–2065	
Growth Rate	0.66
Change in Growth Rate	0.43
Growth with Drift	-1.95
Growth	0.74
Change in Growth with Drift	-2.73
Change in Growth	0.58
Mean ⋆	0.04
Median	0.51
U.S.	0.33

Projected Employment and Employment Growth 2016–2065
Utilities

Employment
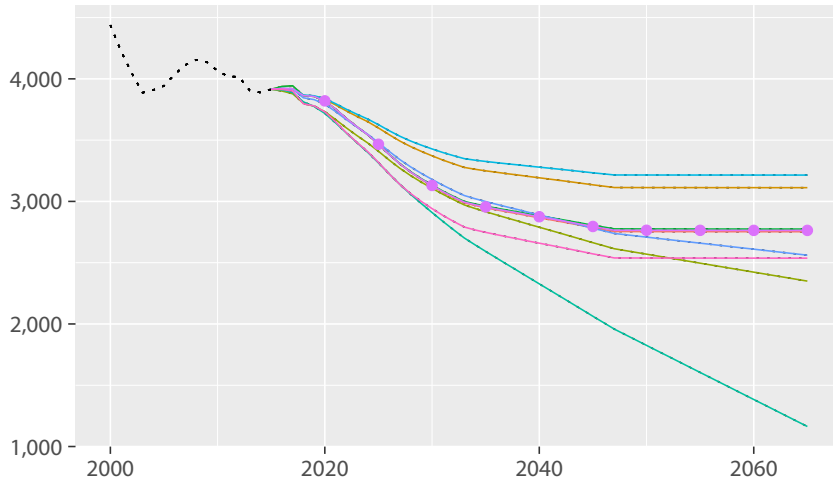
Employment Growth

Employment Growth Rates

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift
- Change in Growth
- Mean
- Median ★
- U.S.
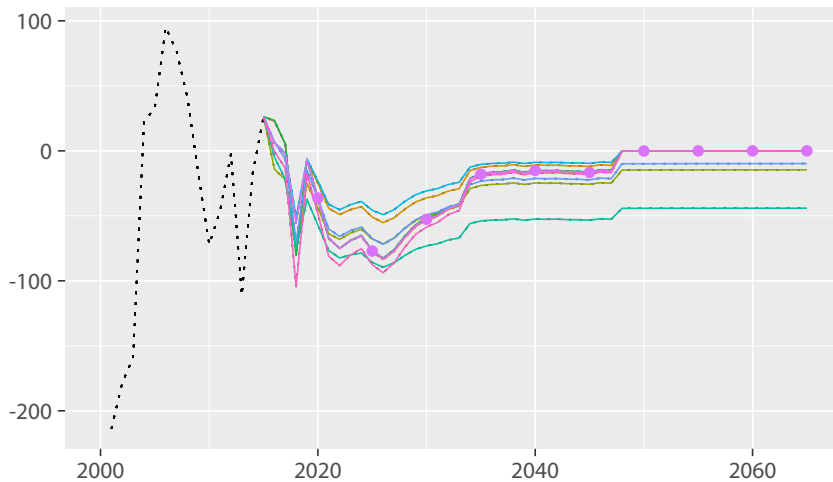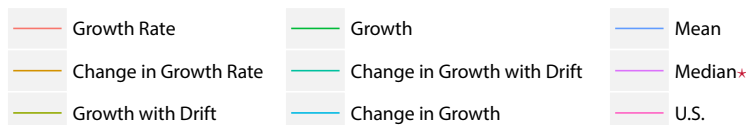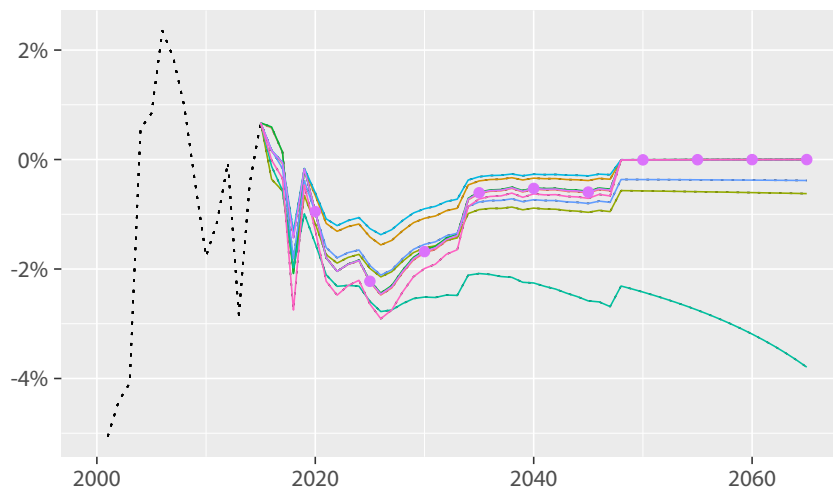
Industry Description Activities of this sector are generating, transmitting, and/or distributing electricity, gas, steam, and water and removing sewage through a permanent infrastructure of lines, mains, and pipe.

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	CAAGR %
2000–2015	
2000–2015	-0.83
2016–2030	
Growth Rate	-1.63
Change in Growth Rate	-1.07
Growth with Drift	-1.61
Growth	-1.62
Change in Growth with Drift	-2.09
Change in Growth	-0.96
Mean	-1.49
Median ★	-1.60
U.S.	-2.02
2016–2065	
Growth Rate	-0.73
Change in Growth Rate	-0.47
Growth with Drift	-1.03
Growth	-0.71
Change in Growth with Drift	-2.44
Change in Growth	-0.40
Mean	-0.87
Median ★	-0.71
U.S.	-0.88

Projected Employment and Employment Growth 2016–2065
Construction

Employment

Employment Growth

Employment Growth Rates

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift★
- Change in Growth
- Mean
- Median
- U.S.
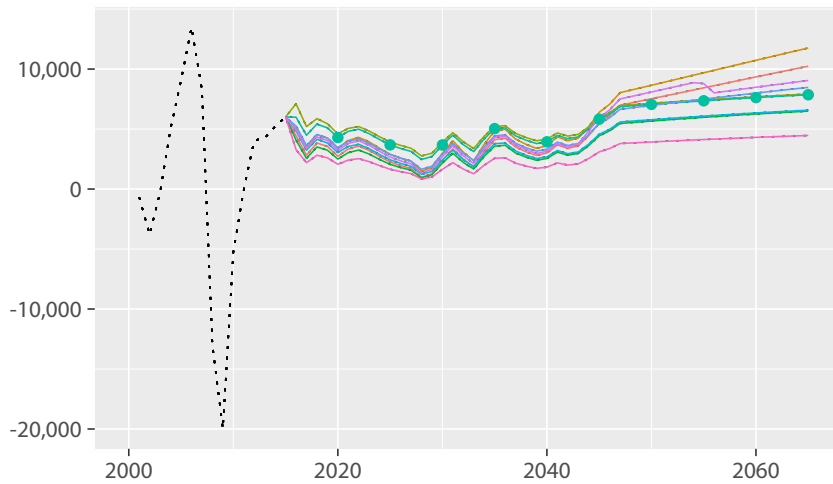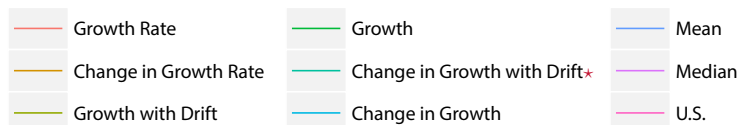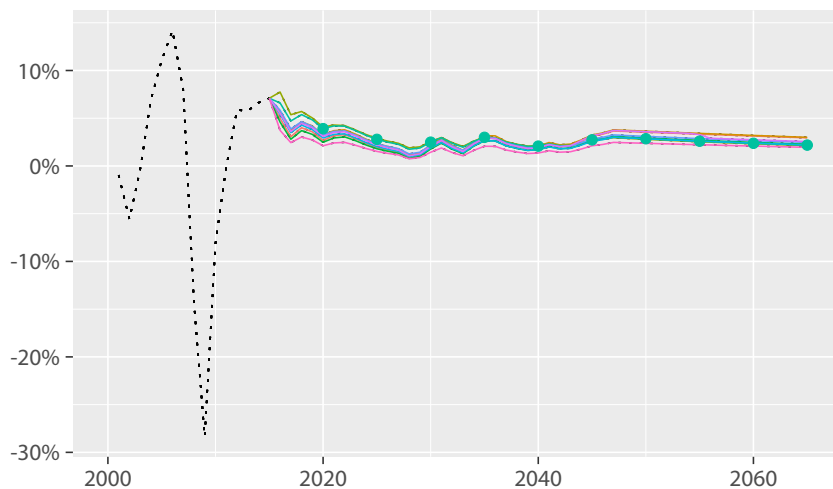
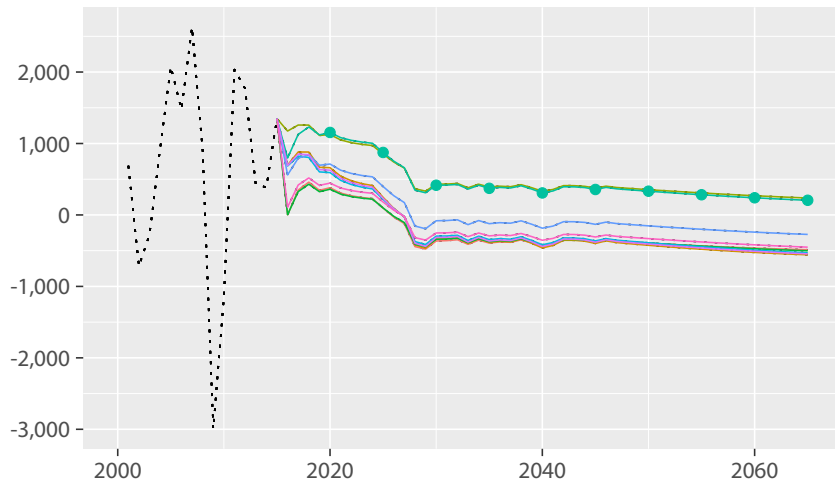**Industry Description** Activities of this sector are erecting buildings and other structures (including additions); heavy construction other than buildings; and alterations, reconstruction, installation, and maintenance and repairs.

About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, and a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S. The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case Change in Growth with Drift, is marked with dots in the graphs and a star in the legend and table.

	CAAGR %
2000–2015	
2000–2015	1.06
2016–2030	
Growth Rate	2.47
Change in Growth Rate	2.97
Growth with Drift	3.72
Growth	2.29
Change in Growth with Drift ★	3.54
Change in Growth	2.64
Mean	2.96
Median	2.80
U.S.	1.91
2016–2065	
Growth Rate	2.82
Change in Growth Rate	3.06
Growth with Drift	2.89
Growth	2.41
Change in Growth with Drift ★	2.85
Change in Growth	2.48
Mean	2.76
Median	2.84
U.S.	1.97

Projected Employment and Employment Growth 2016–2065
Manufacturing

Employment

Employment Growth
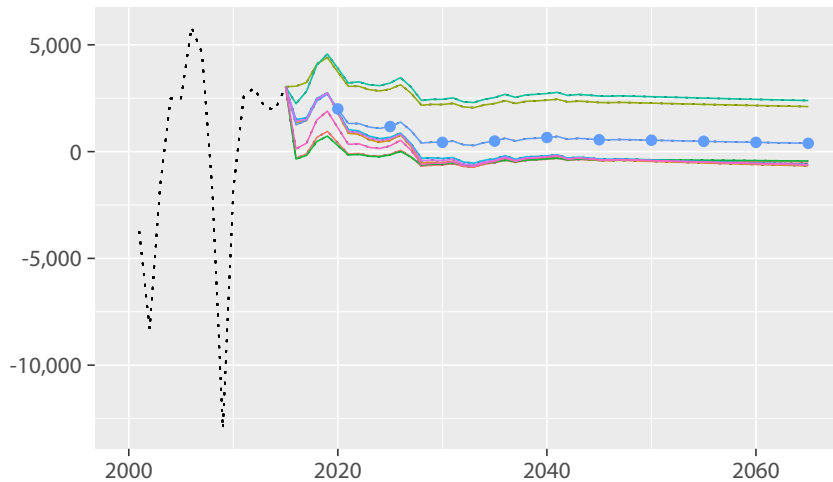
Employment Growth Rates

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift
- Change in Growth
- Mean ★
- Median
- U.S.
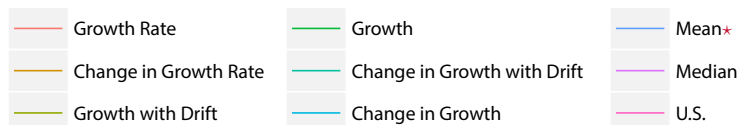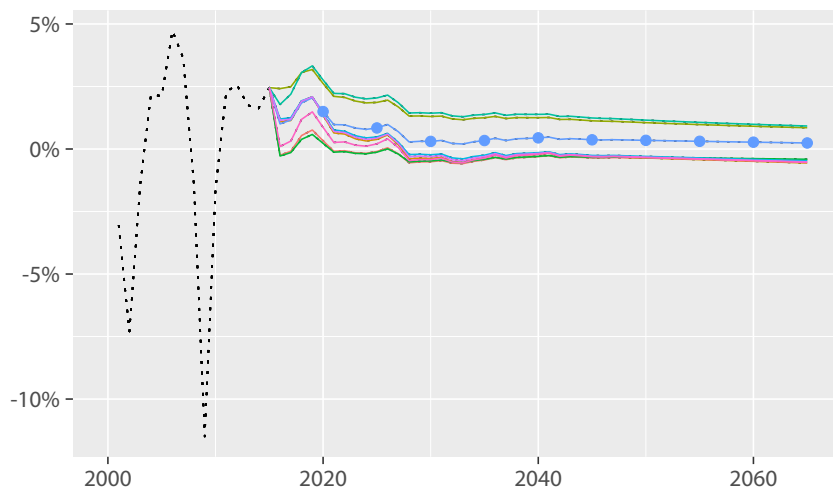
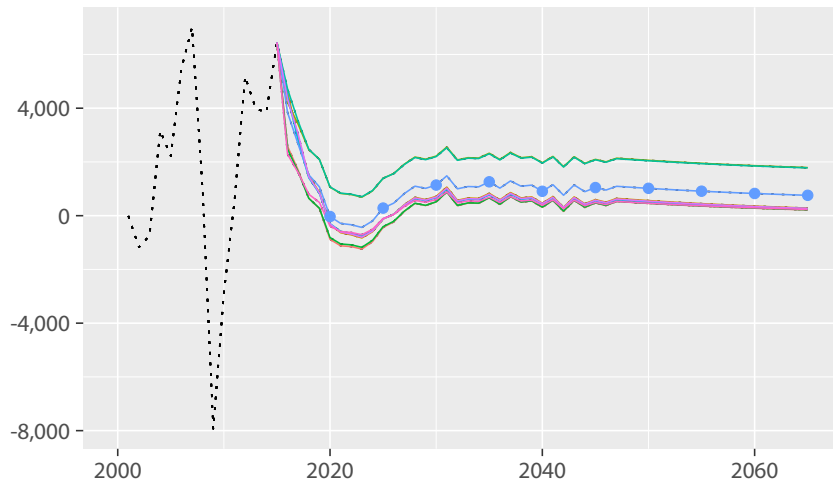**Industry Description** According to the U.S. Census Bureau, "Activities of this sector are the mechanical, physical, or chemical transformation of materials, substances, or components into new products."

About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, and a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S. The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case the Mean, is marked with dots in the graphs and a star in the legend and table.

	CAAGR %
2000–2015	
2000–2015	-0.12
2016–2030	
Growth Rate	-0.05
Change in Growth Rate	0.61
Growth with Drift	2.10
Growth	-0.10
Change in Growth with Drift	2.21
Change in Growth	0.71
Mean ★	0.98
Median	0.66
U.S.	0.29
2016–2065	
Growth Rate	-0.30
Change in Growth Rate	-0.10
Growth with Drift	1.38
Growth	-0.29
Change in Growth with Drift	1.49
Change in Growth	-0.01
Mean ★	0.52
Median	-0.06
U.S.	-0.19

Projected Employment and Employment Growth 2016–2065
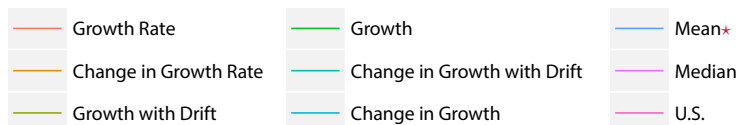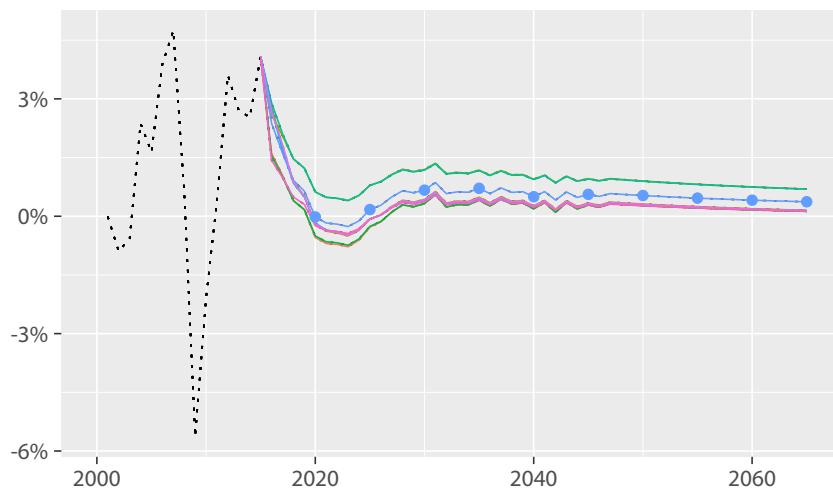## Wholesale trade

Employment
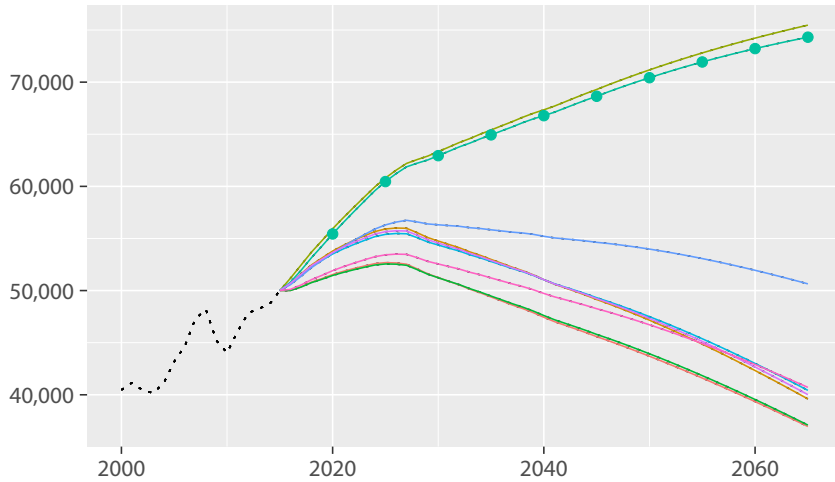
Employment Growth

Employment Growth Rates
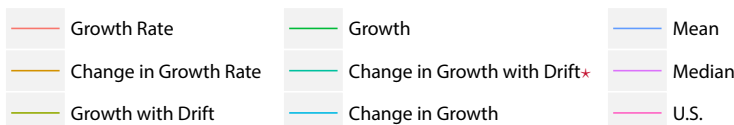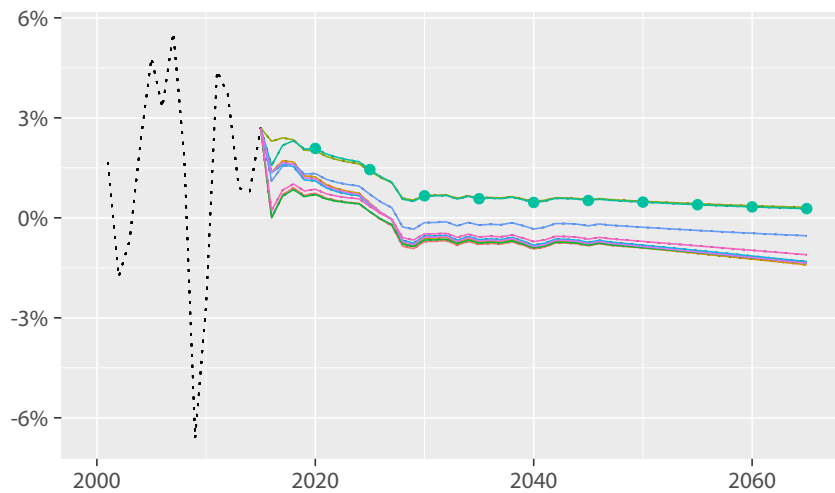
Industry Description According to the U.S. Census Bureau, "Activities of this sector are selling or arranging for the purchase or sale of goods for resale; capital or durable nonconsumer goods; and raw and intermediate materials and supplies used in production, and providing services incidental to the sale of the merchandise."

About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, and a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S. The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case Change in Growth with Drift, is marked with dots in the graphs and a star in the legend and table.

	CAAGR %
2000–2015	
2000–2015	1.42
2016–2030	
Growth Rate	0.18
Change in Growth Rate	0.55
Growth with Drift	1.53
Growth	0.17
Change in Growth with Drift ★	1.54
Change in Growth	0.50
Mean	0.77
Median	0.53
U.S.	0.34
2016–2065	
Growth Rate	-0.62
Change in Growth Rate	-0.50
Growth with Drift	0.80
Growth	-0.61
Change in Growth with Drift ★	0.78
Change in Growth	-0.46
Mean	0.00
Median	-0.48
U.S.	-0.42

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift ★
- Change in Growth
- Mean
- Median
- U.S.

Projected Employment and Employment Growth 2016–2065
Retail trade

Employment
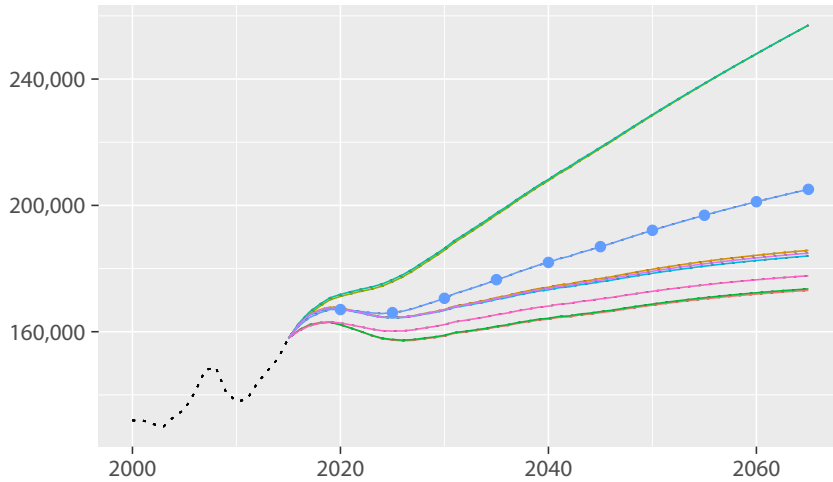
Employment Growth

Employment Growth Rates

Industry Description According to the U.S. Census Bureau, "Activities of this sector are retailing merchandise generally in small quantities to the general public and providing services incidental to the sale of the merchandise."
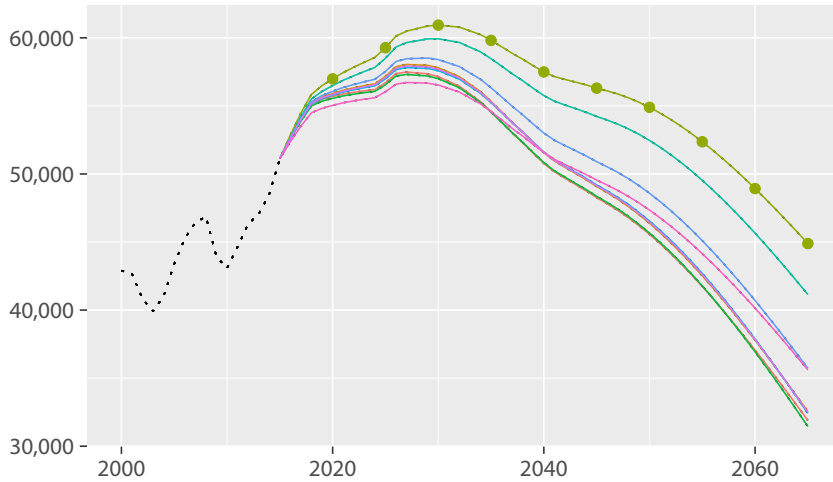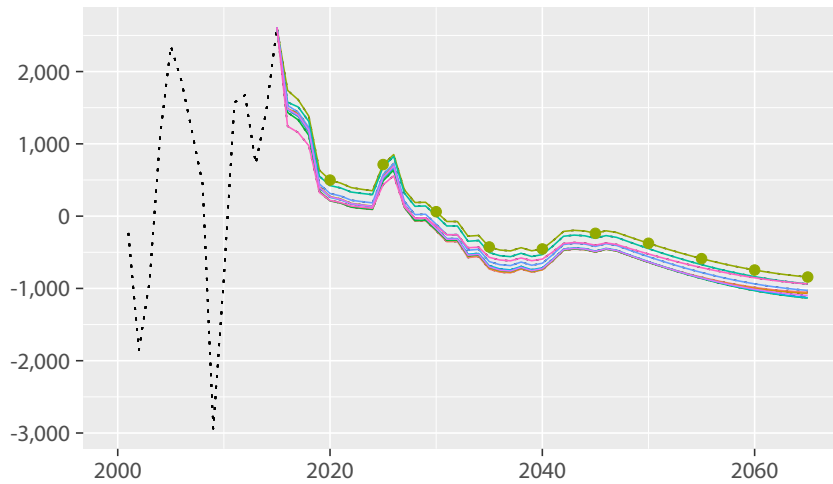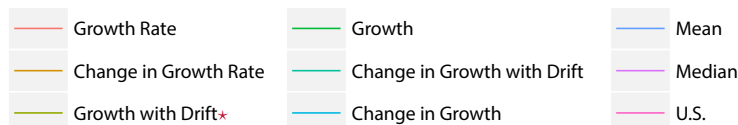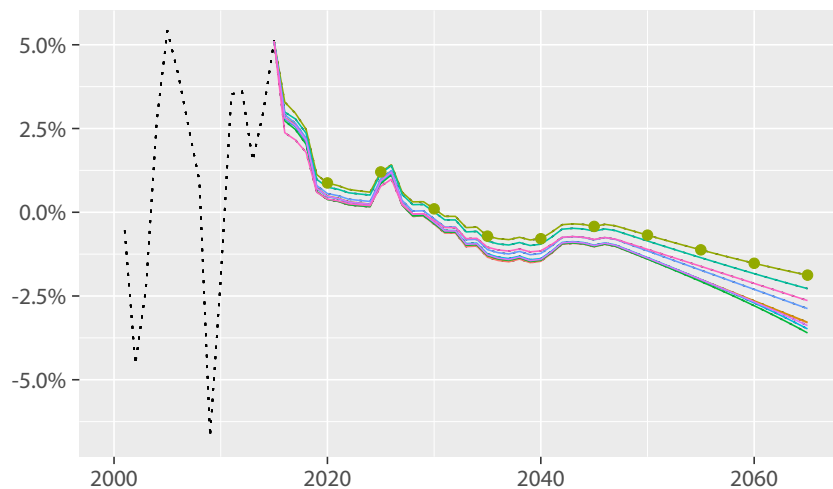
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	CAAGR %
2000–2015	
2000–2015	1.21
2016–2030	
Growth Rate	-0.09
Change in Growth Rate	0.19
Growth with Drift	0.98
Growth	-0.07
Change in Growth with Drift	0.98
Change in Growth	0.19
Mean ★	0.38
Median	0.20
U.S.	0.09
2016–2065	
Growth Rate	0.15
Change in Growth Rate	0.27
Growth with Drift	0.94
Growth	0.16
Change in Growth with Drift	0.94
Change in Growth	0.25
Mean ★	0.48
Median	0.27
U.S.	0.21

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift
- Change in Growth
- Mean ★
- Median
- U.S.

Projected Employment and Employment Growth 2016–2065
Transportation and Warehousing

Employment

Employment Growth

Employment Growth Rates

Industry Description According to the U.S. Census Bureau, "Activities of this sector are providing transportation of passengers and cargo, warehousing and storing goods, scenic and sightseeing transportation, and supporting these activities."
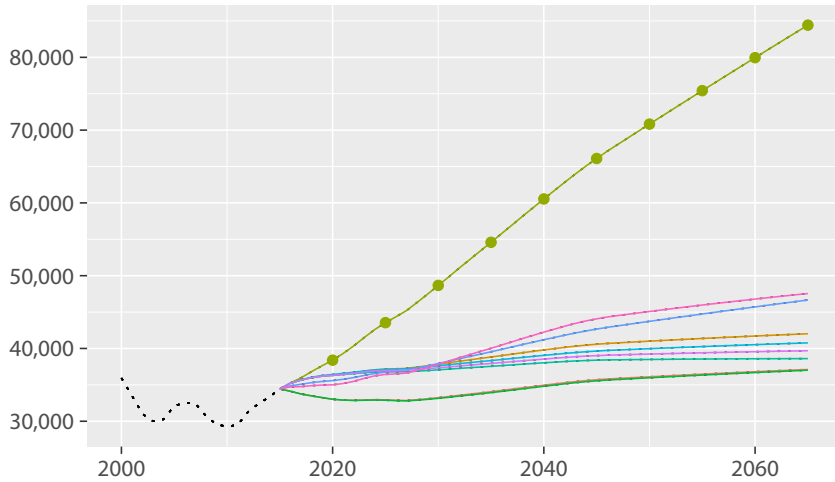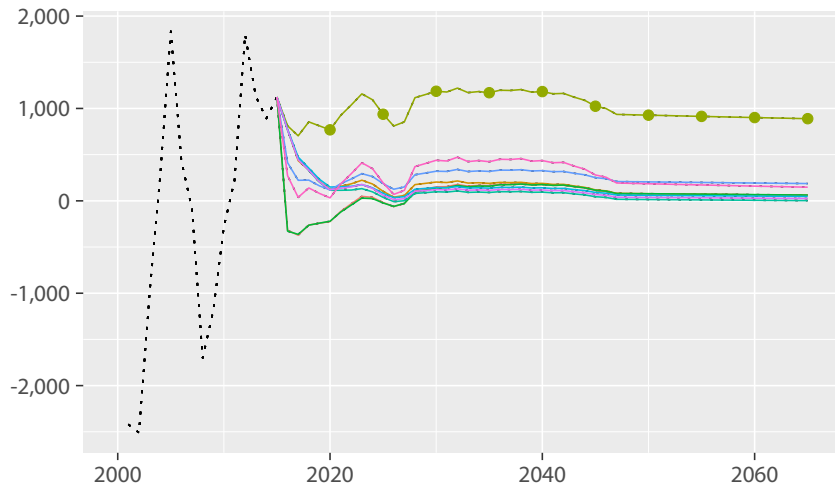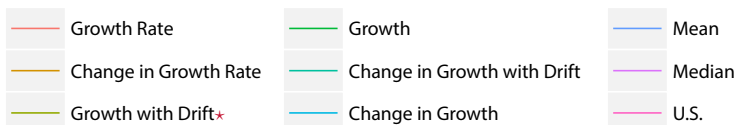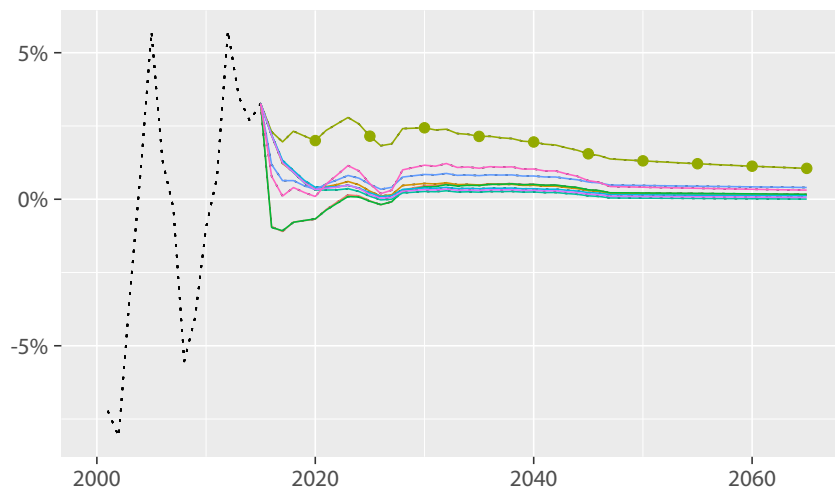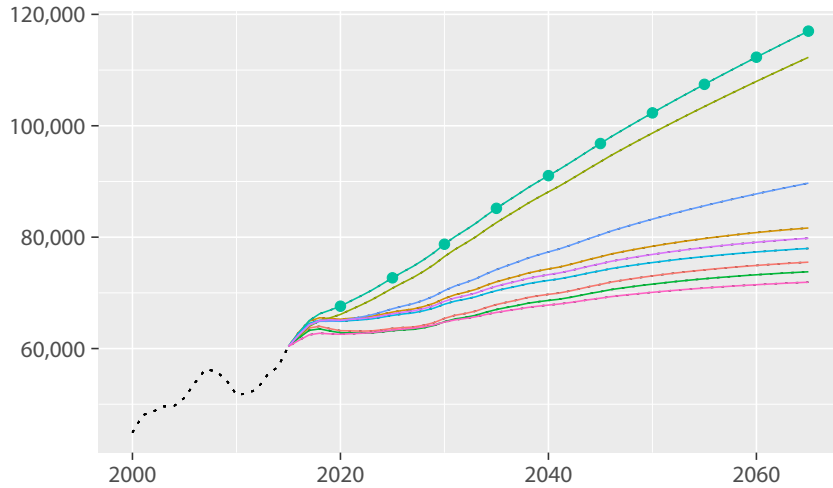
About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, and a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S. The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case Growth with Drift, is marked with dots in the graphs and a star in the legend and table.

	CAAGR %
2000–2015	
2000–2015	1.18
2016–2030	
Growth Rate	0.59
Change in Growth Rate	0.67
Growth with Drift ★	1.02
Growth	0.58
Change in Growth with Drift	0.92
Change in Growth	0.65
Mean	0.74
Median	0.66
U.S.	0.55
2016–2065	
Growth Rate	-1.02
Change in Growth Rate	-0.98
Growth with Drift	-0.33
Growth	-1.04
Change in Growth with Drift	-0.50
Change in Growth ★	-0.98
Mean	-0.79
Median	-0.98
U.S.	-0.78

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift ★
- Growth
- Change in Growth with Drift
- Change in Growth
- Mean
- Median
- U.S.

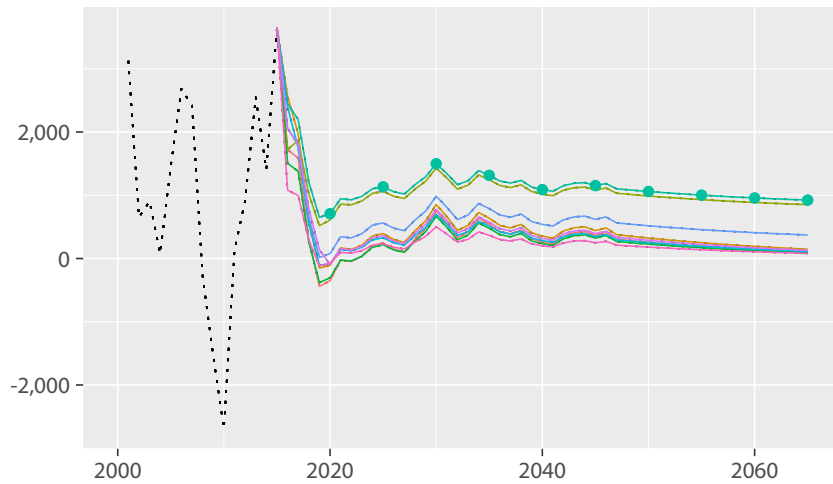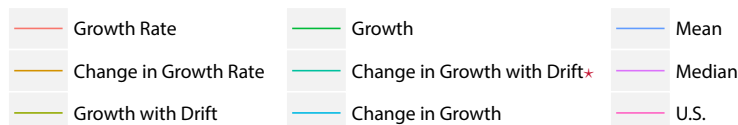# Projected Employment and Employment Growth 2016–2065
Information

Employment

Employment Growth

Employment Growth Rates

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift ★
- Growth
- Change in Growth with Drift
- Change in Growth
- Mean
- Median
- U.S.

Industry Description According to the U.S. Census Bureau, "Activities of this sector are distributing information and cultural products, providing the means to transmit or distribute these products as data or communications, and processing data."
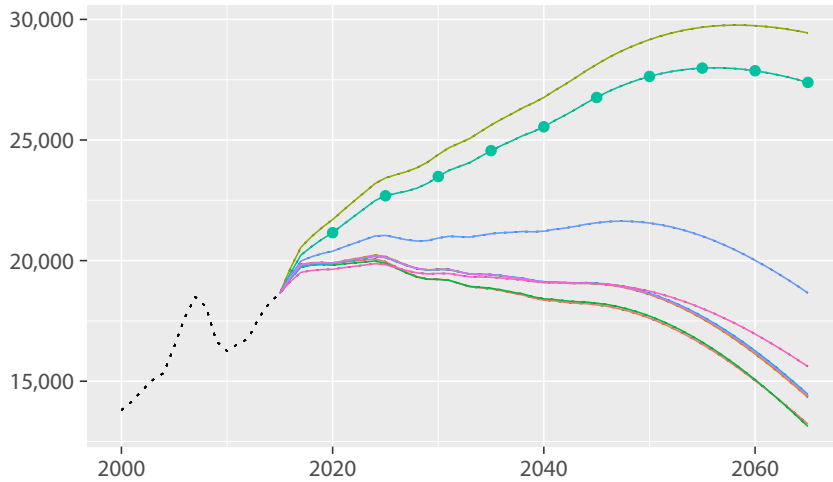
About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, and a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S. The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case Growth with Drift, is marked with dots in the graphs and a star in the legend and table.

	CAAGR %
2000–2015	
2000–2015	-0.28
2016–2030	
Growth Rate	-0.19
Change in Growth Rate	0.51
Growth with Drift ★	2.33
Growth	-0.20
Change in Growth with Drift	0.37
Change in Growth	0.47
Mean	0.61
Median	0.42
U.S.	0.62
2016–2065	
Growth Rate	0.17
Change in Growth Rate	0.36
Growth with Drift ★	1.80
Growth	0.17
Change in Growth with Drift	0.19
Change in Growth	0.30
Mean	0.60
Median	0.24
U.S.	0.64

Projected Employment and Employment Growth 2016–2065
Finance and Insurance

Employment

Employment Growth

Employment Growth Rates

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift ★
- Change in Growth
- Mean
- Median
- U.S.
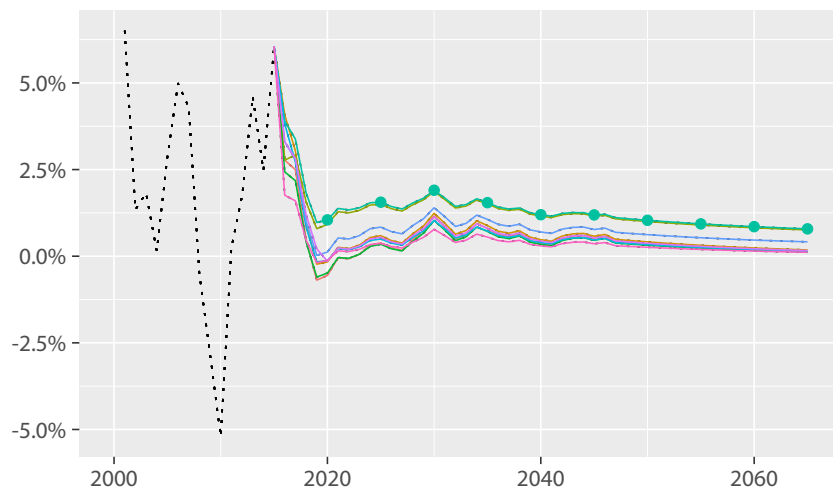
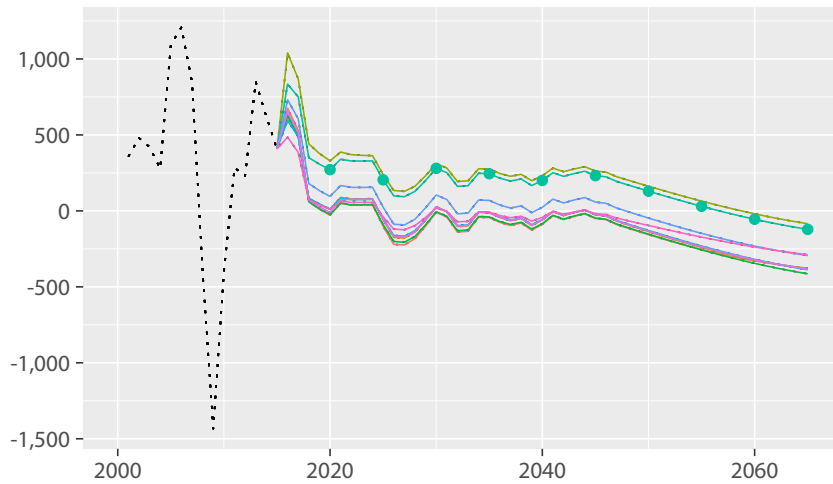**Industry Description** According to the U.S. Census Bureau, "Activities of this sector involve the creation, liquidation, or change in ownership of financial assets (financial transactions) and/or facilitating financial transactions."

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	CAAGR %
2000–2015	
2000–2015	1.99
2016–2030	
Growth Rate	0.37
Change in Growth Rate	0.66
Growth with Drift	1.50
Growth	0.33
Change in Growth with Drift ★	1.62
Change in Growth	0.57
Mean	0.86
Median	0.66
U.S.	0.37
2016–2065	
Growth Rate	0.40
Change in Growth Rate	0.53
Growth with Drift	1.22
Growth	0.36
Change in Growth with Drift ★	1.28
Change in Growth	0.44
Mean	0.74
Median	0.50
U.S.	0.32

Projected Employment and Employment Growth 2016–2065
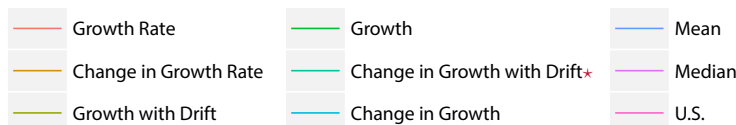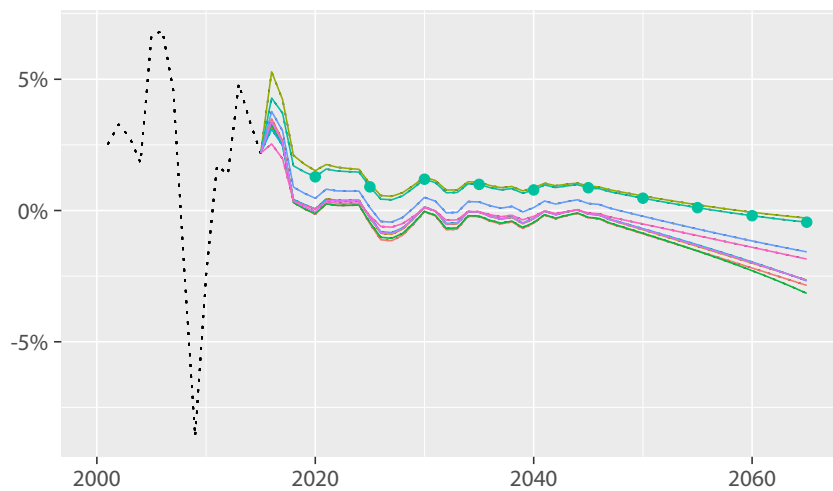## Real Estate and Rental and Leasing

Employment

Employment Growth

Employment Growth Rates

Industry Description According to the U.S. Census Bureau, "Activities of this sector are renting, leasing, or otherwise allowing the use of tangible or intangible assets (except copyrighted works), and providing related services."
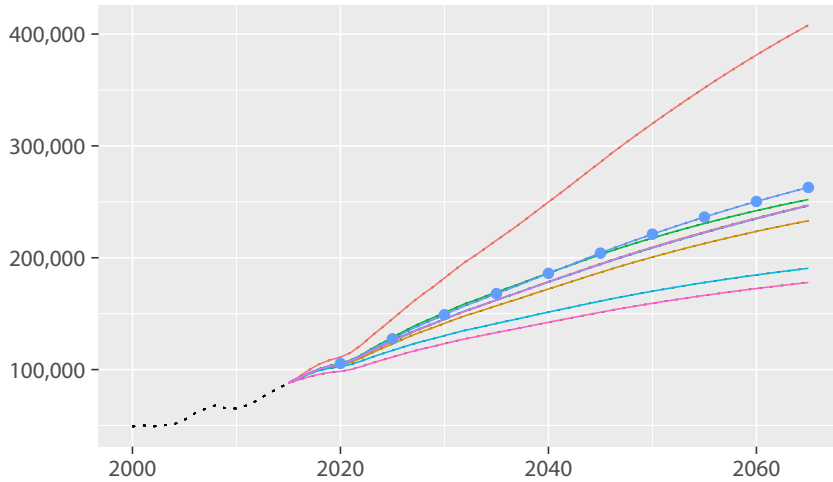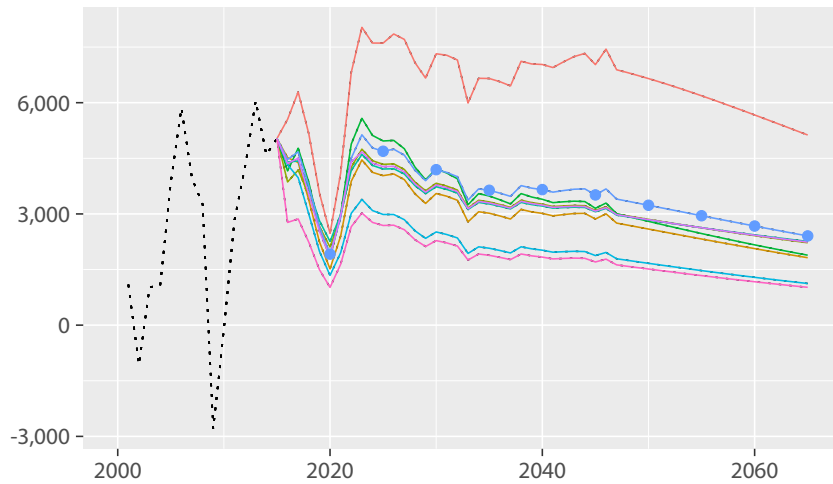
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	CAAGR %
2000–2015	
2000–2015	2.02
2016–2030	
Growth Rate	-0.03
Change in Growth Rate	0.14
Growth with Drift	1.54
Growth	-0.02
Change in Growth with Drift ★	1.35
Change in Growth	0.14
Mean	0.55
Median	0.13
U.S.	0.13
2016–2065	
Growth Rate	-0.77
Change in Growth Rate	-0.60
Growth with Drift	0.82
Growth	-0.78
Change in Growth with Drift ★	0.70
Change in Growth	-0.58
Mean	-0.08
Median	-0.60
U.S.	-0.41

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift ★
- Change in Growth
- Mean
- Median
- U.S.

Projected Employment and Employment Growth 2016–2065
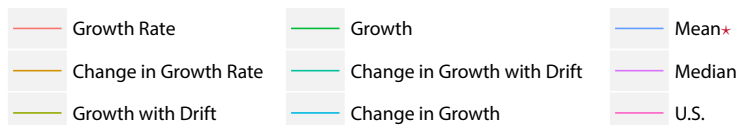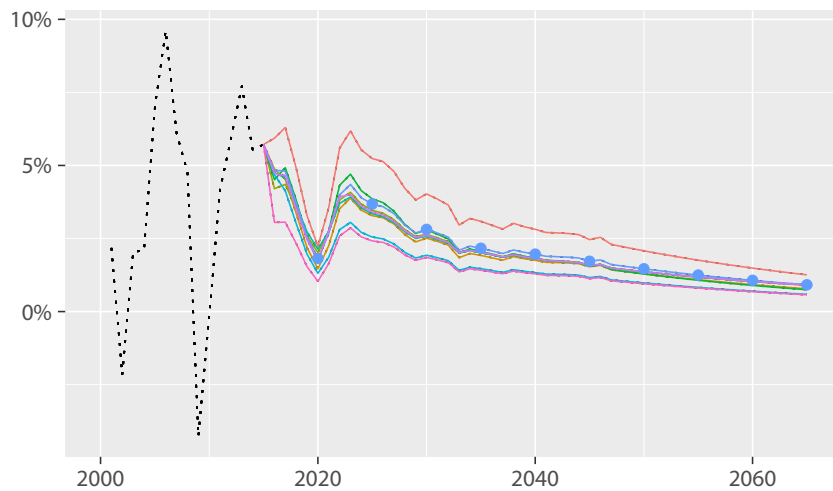## Professional and Technical Services

Employment

Employment Growth

Employment Growth Rates

Industry Description According to the U.S. Census Bureau, "Activities of this sector are performing professional, scientific, and technical services for the operations of other organizations."
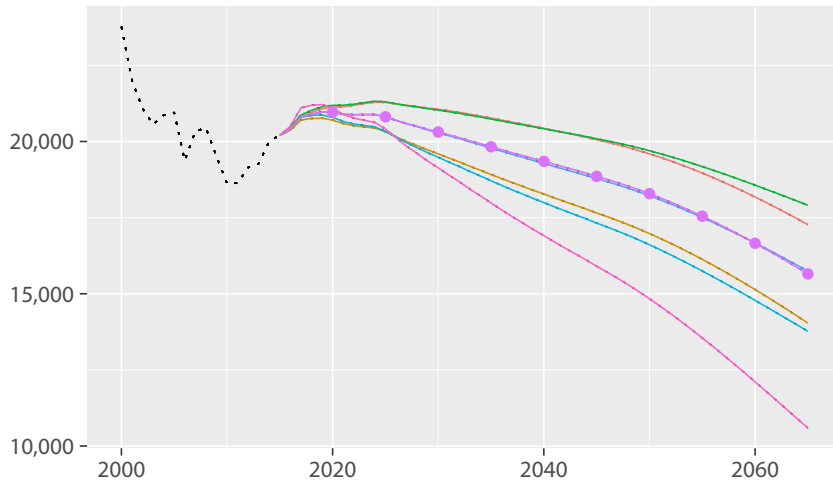
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	CAAGR %
2000–2015	
2000–2015	3.97
2016–2030	
Growth Rate	4.86
Change in Growth Rate	3.07
Growth with Drift	3.31
Growth	3.58
Change in Growth with Drift	3.28
Change in Growth	2.49
Mean ★	3.47
Median	3.28
U.S.	2.20
2016–2065	
Growth Rate	3.05
Change in Growth Rate	1.90
Growth with Drift	2.04
Growth	2.07
Change in Growth with Drift	2.02
Change in Growth	1.49
Mean ★	2.15
Median	2.03
U.S.	1.38

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift
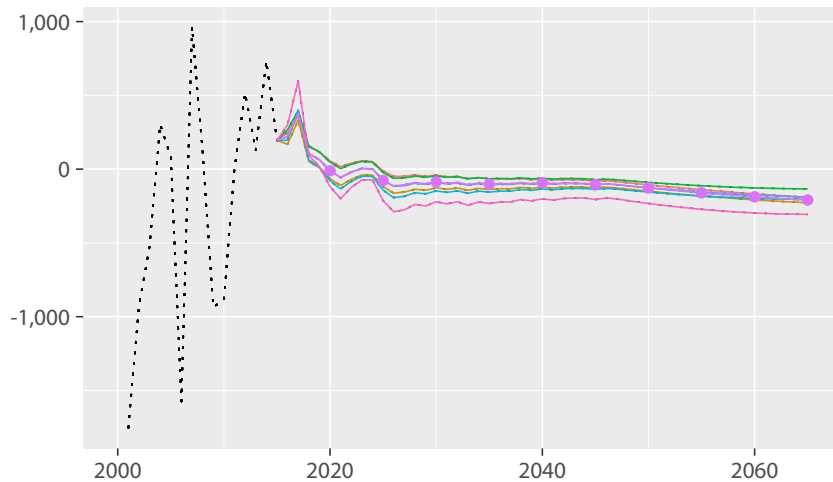- Change in Growth
- Mean ★
- Median
- U.S.

Projected Employment and Employment Growth 2016–2065
Management of Companies and Enterprises

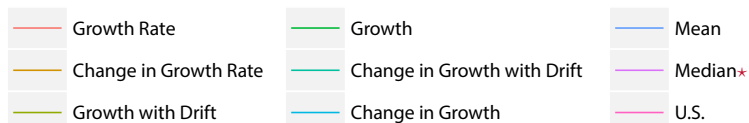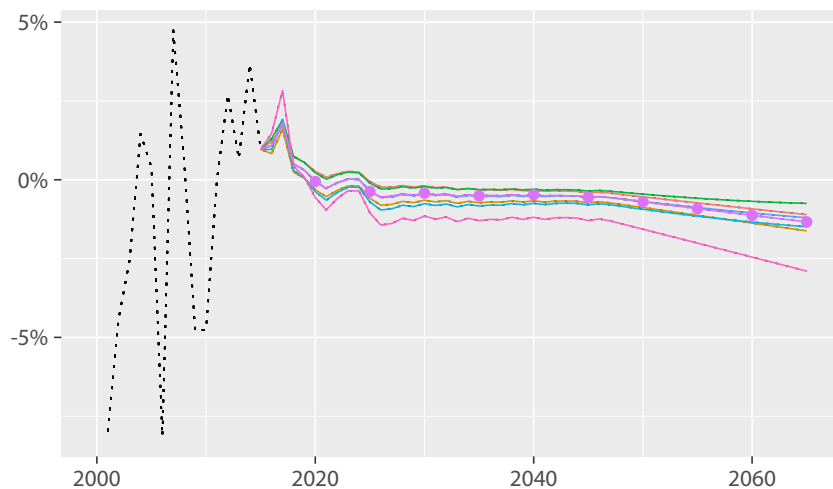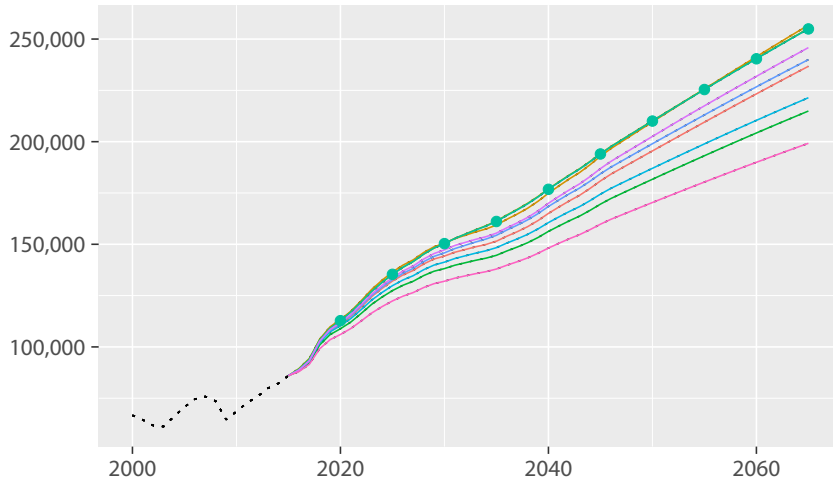**Employment**

Employment Growth

Employment Growth Rates

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift
- Change in Growth
- Mean
- Median★
- U.S.

Industry Description According to the U.S. Census Bureau, "Activities of this sector are the holding of securities of companies and enterprises, for the purpose of owning controlling interest or influencing their management decisions, or administering, overseeing, and managing other establishments of the same company or enterprise and normally undertaking the strategic or organizational planning and decision-making role of the company or enterprise."

About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, and a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S. The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case the Median, is marked with dots in the graphs and a star in the legend and table. The Growth with Drift and Change in Growth with Drift models led to negative predictions for this sector and so are omitted from the graphs, tables, and all calculations.

|	CAAGR %
2000–2015	
2000–2015	-1.08
2016–2030	
Growth Rate	0.21
Change in Growth Rate	-0.28
Growth with Drift	NA
Growth	0.19
Change in Growth with Drift	NA
Change in Growth	-0.33
Mean	-0.05
Median ★	-0.04
U.S.	-0.49
2016–2065	
Growth Rate	-0.34
Change in Growth Rate	-0.76
Growth with Drift	NA
Growth	-0.27
Change in Growth with Drift	NA
Change in Growth	-0.80
Mean	-0.53
Median ★	-0.54
U.S.	-1.34

Projected Employment and Employment Growth 2016–2065
Administrative and Waste Services

Employment
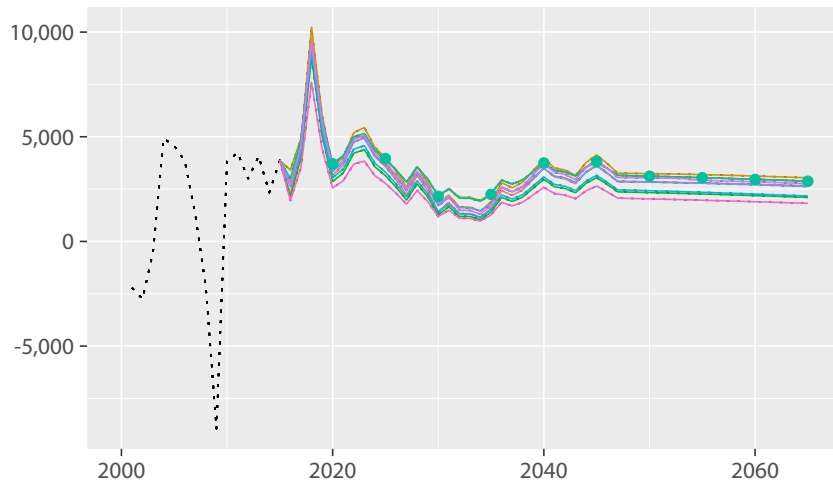
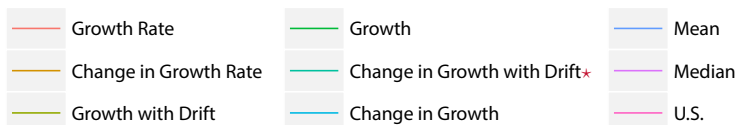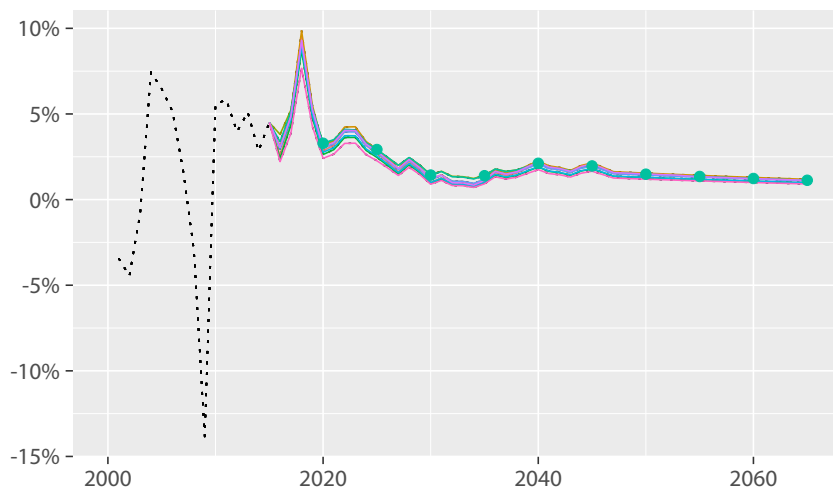**Employment Growth**

Employment Growth Rates

Industry Description According to the U.S. Census Bureau, "Activities of this sector are performing routine support activities for the day-to-day operations of other organizations."
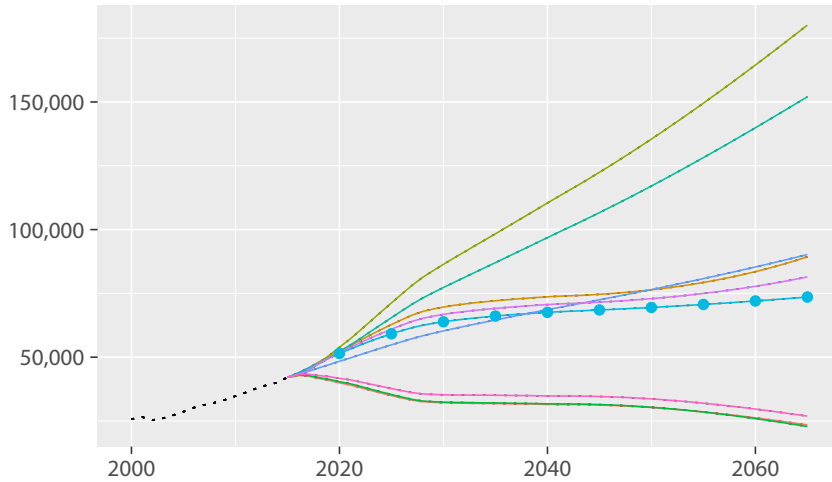
About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, and a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S. The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case Change in Growth with Drift, is marked with dots in the graphs and a star in the legend and table.

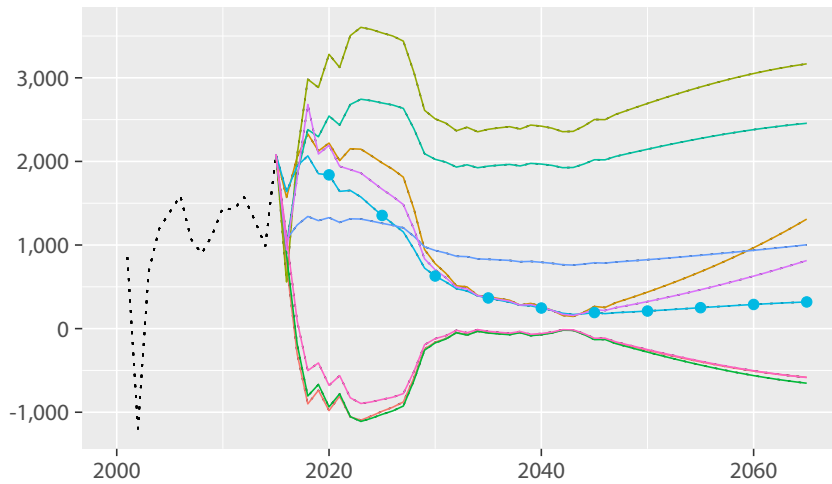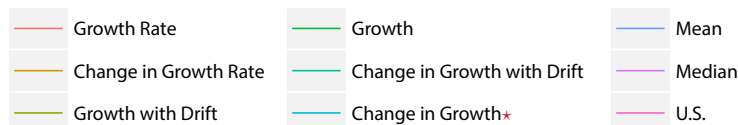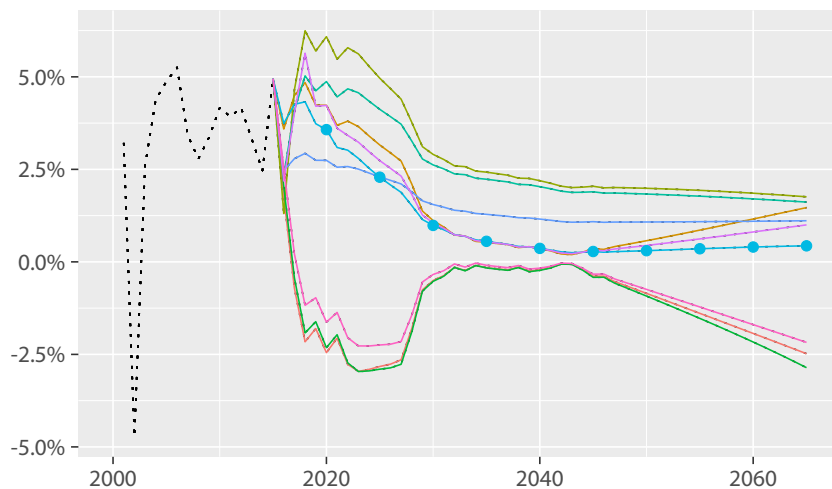|	CAAGR %
2000–2015	
2000–2015	1.71
2016–2030	
Growth Rate	3.57
Change in Growth Rate	3.84
Growth with Drift	3.78
Growth	3.26
Change in Growth with Drift ★	3.81
Change in Growth	3.39
Mean	3.61
Median	3.69
U.S.	2.94
2016–2065	
Growth Rate	2.03
Change in Growth Rate	2.19
Growth with Drift	2.16
Growth	1.84
Change in Growth with Drift ★	2.17
Change in Growth	1.89
Mean	2.05
Median	2.10
U.S.	1.68

Projected Employment and Employment Growth 2016–2065
Educational Services

Employment

Employment Growth

Employment Growth Rates

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift
- Change in Growth★
- Mean
- Median
- U.S.

Industry Description According to the U.S. Census Bureau, "Activities of this sector are providing instruction and training in a wide variety of subjects."
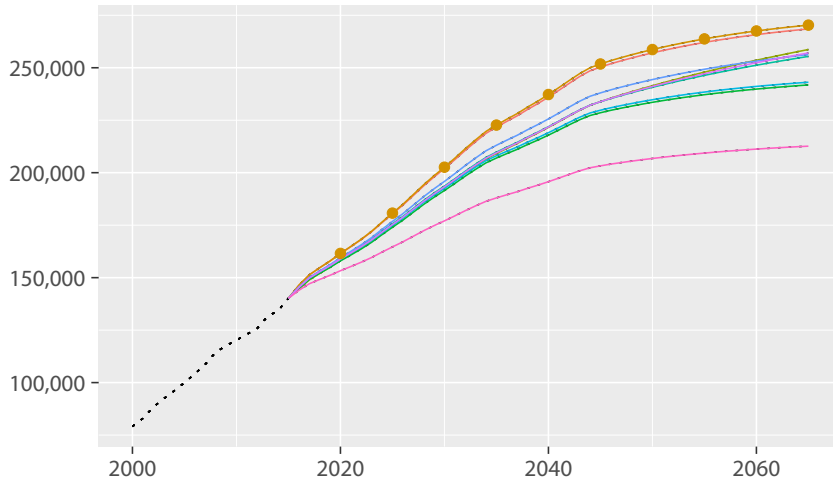
About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, and a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S. The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case Change in Growth, is marked with dots in the graphs and a star in the legend and table.

|	CAAGR %
2000–2015	
2000–2015	3.35
2016–2030	
Growth Rate	-2.03
Change in Growth Rate	3.39
Growth with Drift	5.16
Growth	-2.00
Change in Growth with Drift	4.25
Change in Growth ★	2.74
Mean	2.41
Median	3.18
U.S.	-1.44
2016–2065	
Growth Rate	-1.22
Change in Growth Rate	1.47
Growth with Drift	2.98
Growth	-1.28
Change in Growth with Drift	2.60
Change in Growth ★	1.07
Mean	1.51
Median	1.31
U.S.	-0.96

Projected Employment and Employment Growth 2016–2065
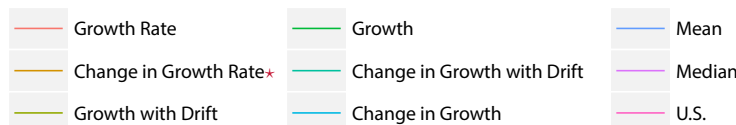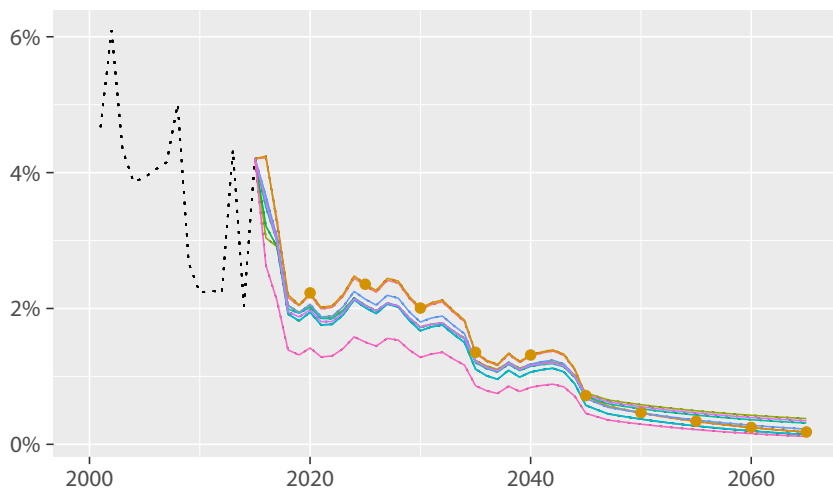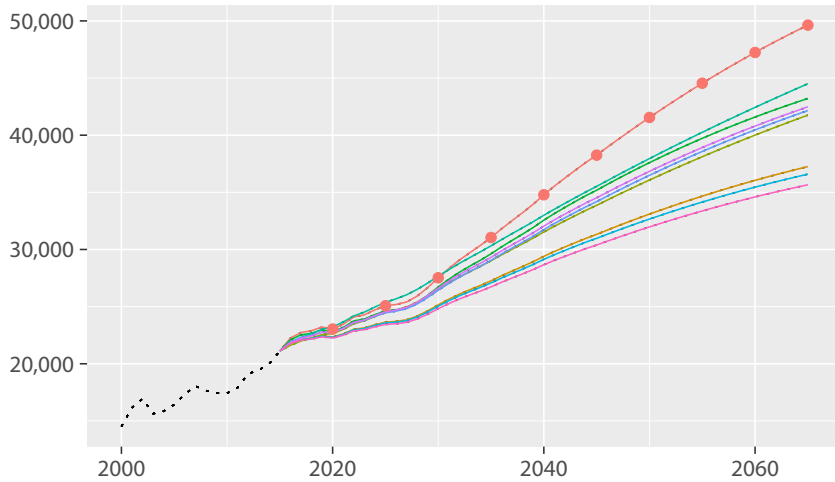## Health Care and Social Assistance

Employment

Employment Growth
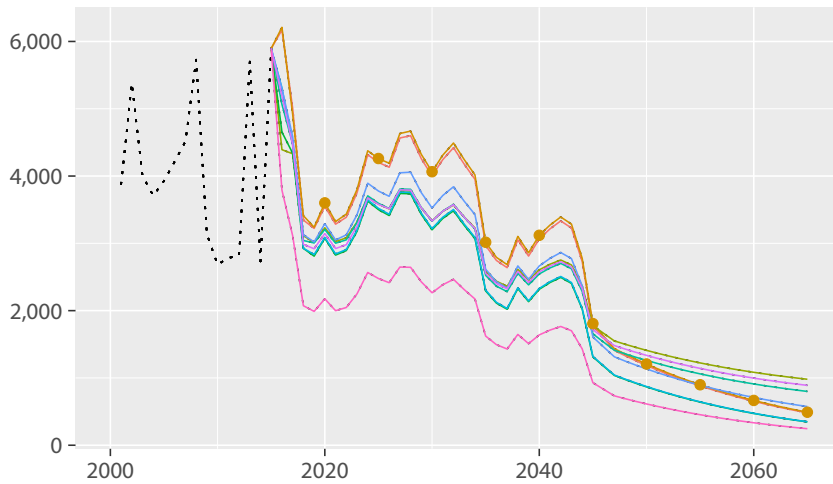
Employment Growth Rates

Industry Description According to the U.S. Census Bureau, "Activities of this sector are providing health care and social assistance for individuals."

About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, and a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S. The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case the Change in Growth Rate, is marked with dots in the graphs and a star in the legend and table.

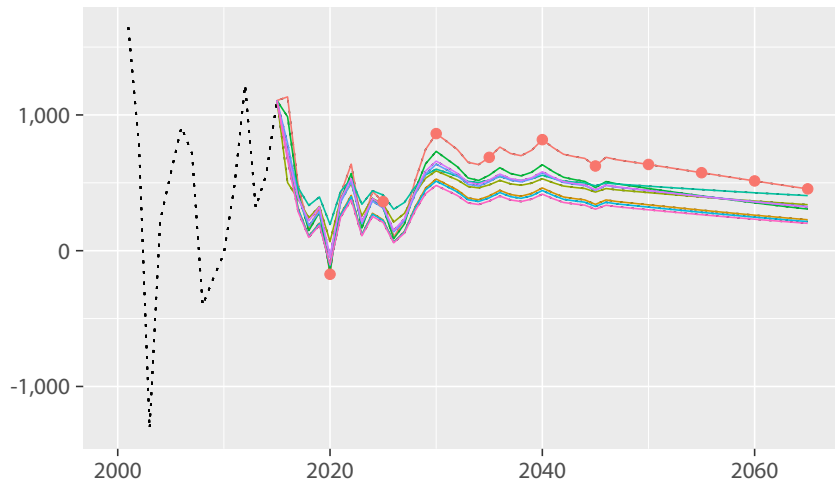|	CAAGR %
2000–2015	
2000–2015	3.89
2016–2030	
Growth Rate	2.33
Change in Growth Rate ★	2.35
Growth with Drift	2.08
Growth	2.02
Change in Growth with Drift	2.08
Change in Growth	2.02
Mean	2.15
Median	2.06
U.S.	1.49
2016–2065	
Growth Rate	1.25
Change in Growth Rate ★	1.26
Growth with Drift	1.19
Growth	1.05
Change in Growth with Drift	1.16
Change in Growth	1.05
Mean	1.16
Median	1.17
U.S.	0.80

Projected Employment and Employment Growth 2016–2065
Arts, Entertainment, and Recreation

Employment

Employment Growth

Employment Growth Rates

Legend:
- Growth Rate ★
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift
- Change in Growth
- Mean
- Median
- U.S.
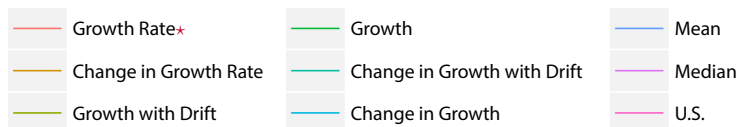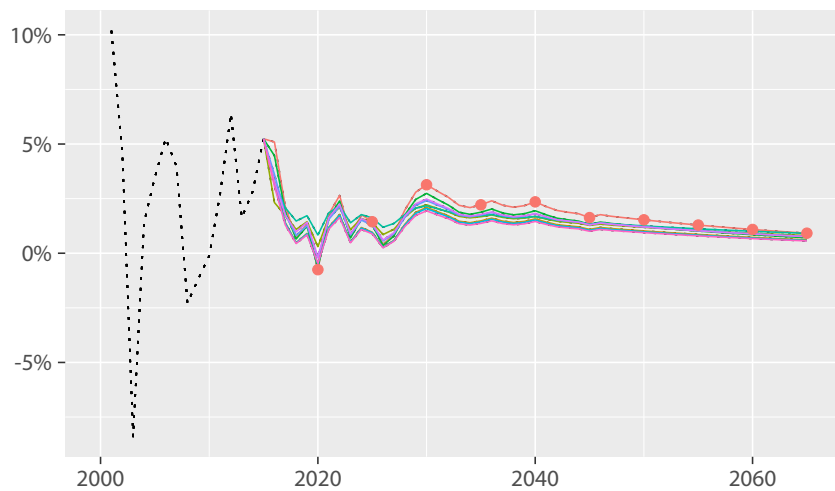
Industry Description According to the U.S. Census Bureau, "Activities of this sector are operating or providing services to meet varied cultural, entertainment, and recreational interests of their patrons."

About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, and a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S. The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case Growth Rate, is marked with dots in the graphs and a star in the legend and table.

	CAAGR %
2000–2015	
2000–2015	2.53
2016–2030	
Growth Rate ★	1.53
Change in Growth Rate	1.02
Growth with Drift	1.47
Growth	1.36
Change in Growth with Drift	1.71
Change in Growth	0.99
Mean	1.35
Median	1.43
U.S.	0.94
2016–2065	
Growth Rate ★	1.65
Change in Growth Rate	1.10
Growth with Drift	1.35
Growth	1.38
Change in Growth with Drift	1.46
Change in Growth	1.06
Mean	1.35
Median	1.37
U.S.	1.01

Projected Employment and Employment Growth 2016–2065
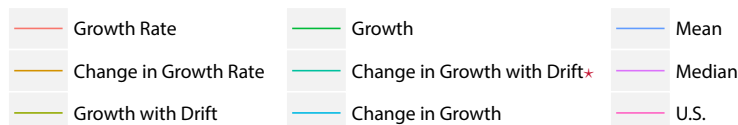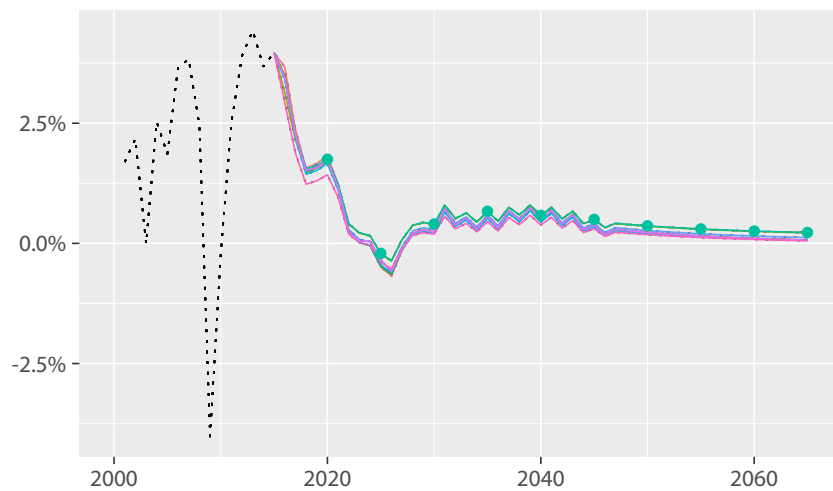## Accommodations and Food Service

Employment
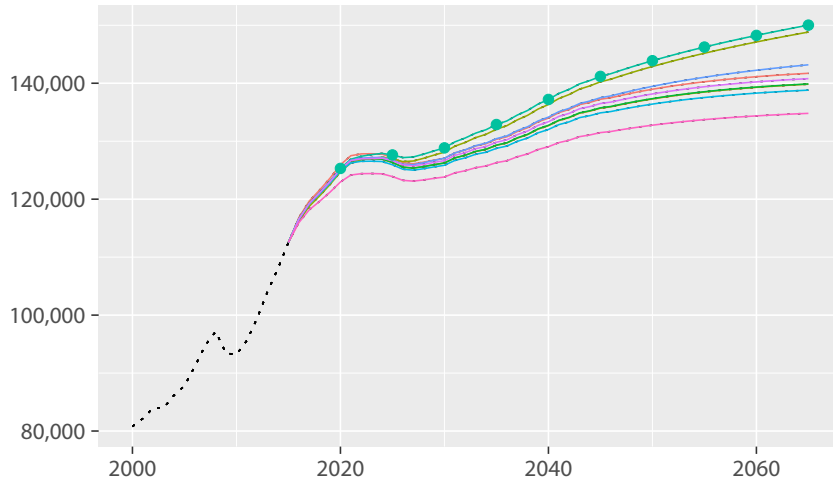
Employment Growth
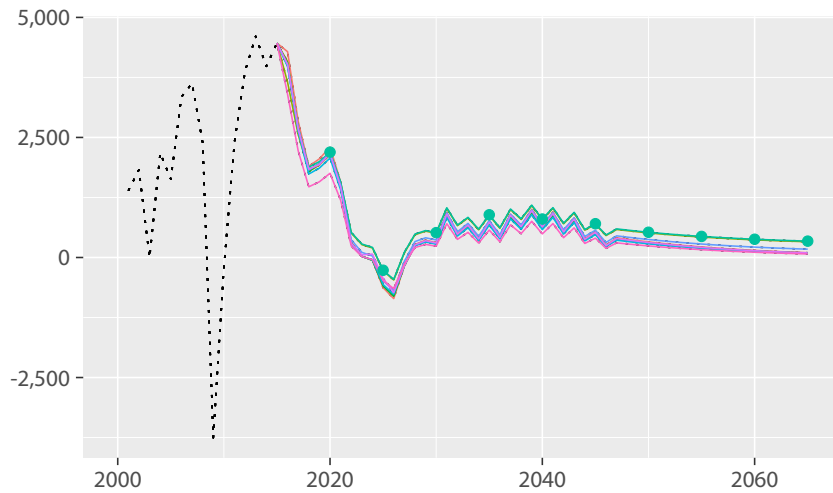
Employment Growth Rates

Industry Description According to the U.S. Census Bureau, "Activities of this sector are providing customers with lodging and/or preparing meals, snacks, and beverages for immediate consumption."
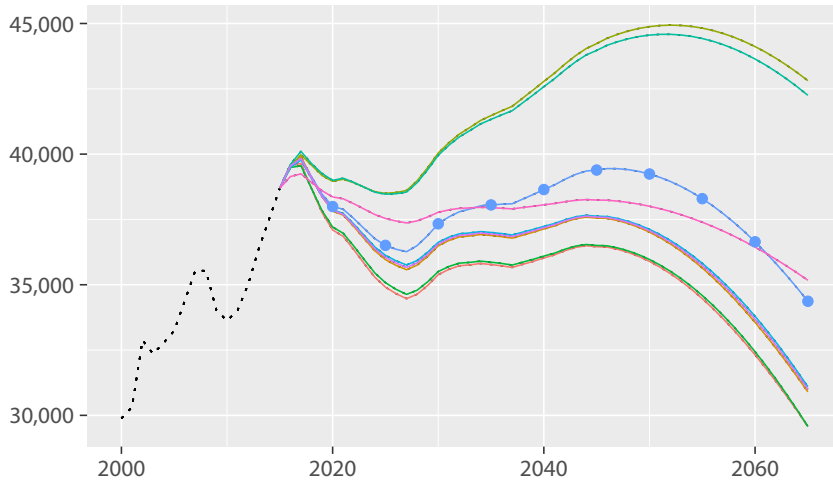
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	CAAGR %
2000–2015	
2000–2015	2.24
2016–2030	
Growth Rate	0.60
Change in Growth Rate	0.57
Growth with Drift	0.70
Growth	0.57
Change in Growth with Drift ★	0.72
Change in Growth	0.55
Mean	0.62
Median	0.59
U.S.	0.47
2016–2065	
Growth Rate	0.39
Change in Growth Rate	0.37
Growth with Drift	0.51
Growth	0.37
Change in Growth with Drift ★	0.52
Change in Growth	0.36
Mean	0.42
Median	0.39
U.S.	0.31

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift ★
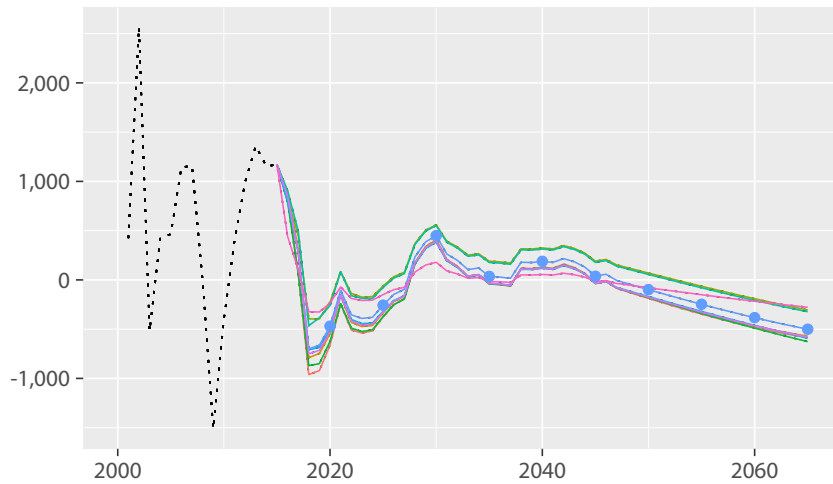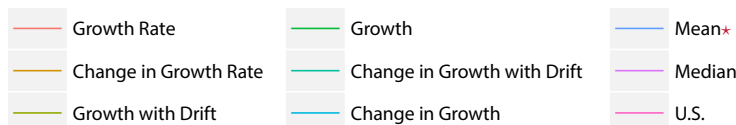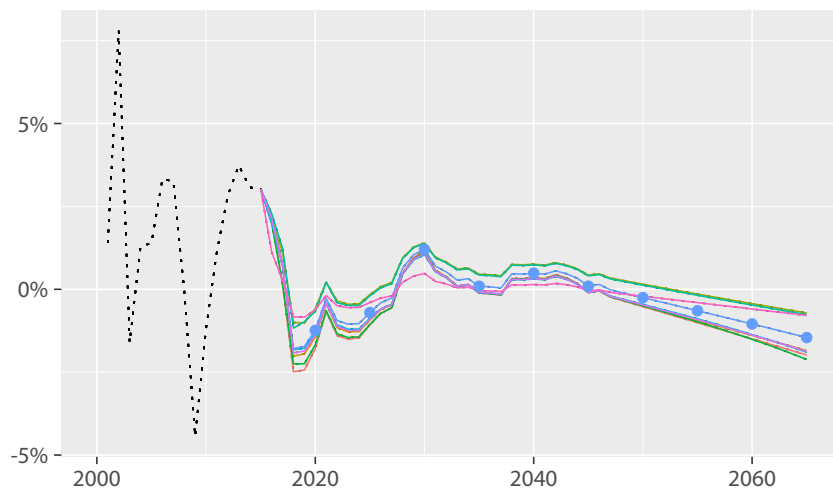- Change in Growth
- Mean
- Median
- U.S.

Projected Employment and Employment Growth 2016–2065

Other Services, Except Public Administration

Employment

Employment Growth

Employment Growth Rates

Legend: Growth Rate · Change in Growth Rate · Growth with Drift · Growth · Change in Growth with Drift · Change in Growth · Mean ★ · Median · U.S.

Industry Description According to the U.S. Census Bureau, "Activities of this sector are providing services not elsewhere specified, including repairs, religious activities, grantmaking, advocacy, laundry, personal care, death care, and other personal services."

About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, and a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S. The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case the Mean, is marked with dots in the graphs and a star in the legend and table.

	CAAGR %
2000–2015	
2000–2015	1.74
2016–2030	
Growth Rate	-0.80
Change in Growth Rate	-0.58
Growth with Drift	0.09
Growth	-0.76
Change in Growth with Drift	0.06
Change in Growth	-0.54
Mean ★	-0.41
Median	-0.56
U.S.	-0.25
2016–2065	
Growth Rate	-0.59
Change in Growth Rate	-0.50
Growth with Drift	0.16
Growth	-0.59
Change in Growth with Drift	0.13
Change in Growth	-0.49
Mean ★	-0.29
Median	-0.50
U.S.	-0.22

Projected Employment and Employment Growth 2016–2065
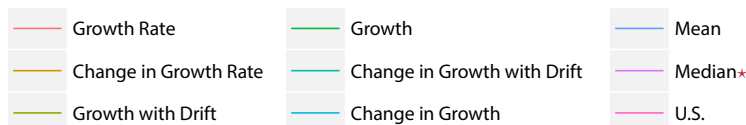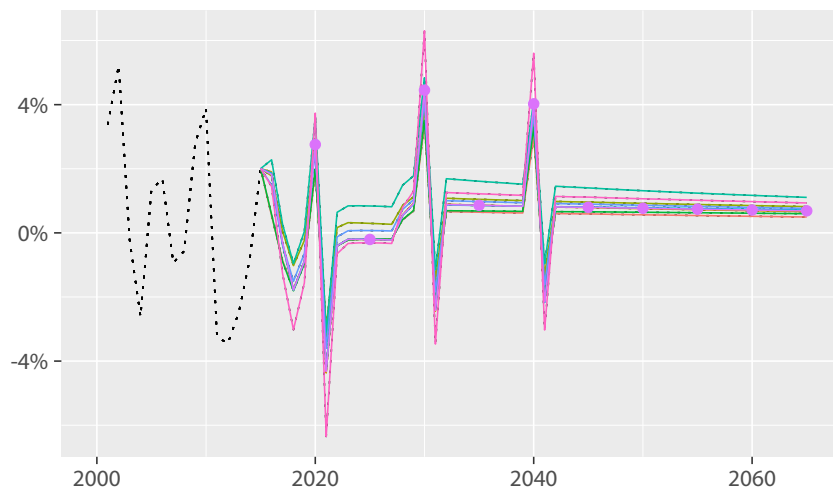## Federal Government

Employment
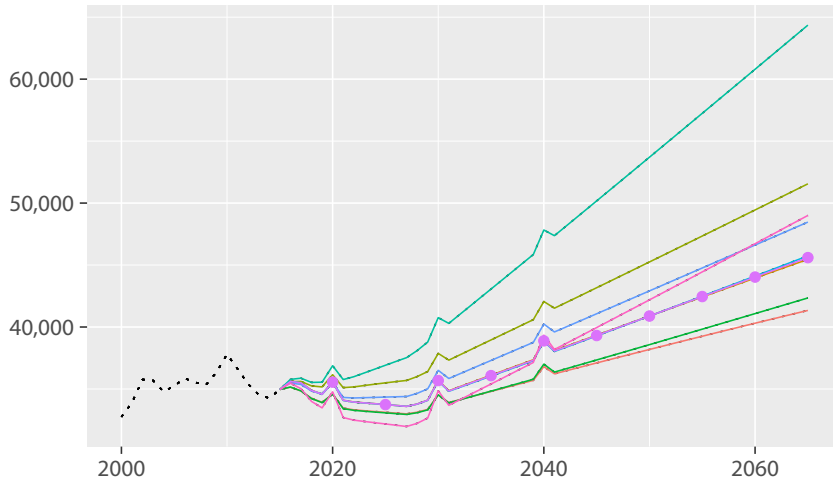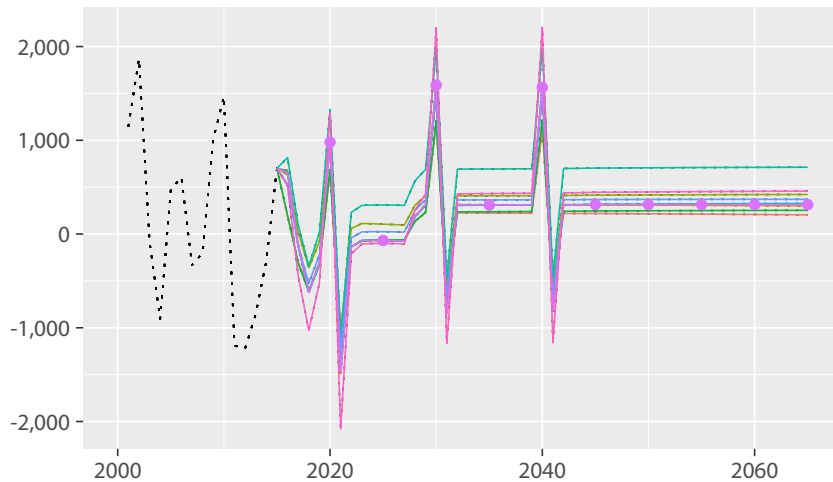
Employment Growth

Employment Growth Rates

Industry Description Activities in this sector may include those of any private-sector industry given elsewhere in this document, but are carried out by federal civilian employees.
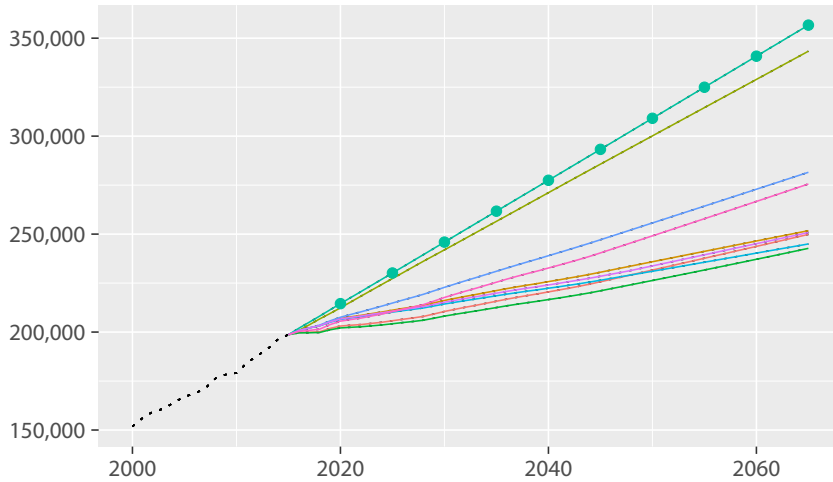
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	CAAGR %
2000–2015	
2000–2015	0.44
2016–2030	
Growth Rate	-0.13
Change in Growth Rate	0.02
Growth with Drift	0.44
Growth	-0.13
Change in Growth with Drift	0.94
Change in Growth	0.01
Mean	0.20
Median ★	0.01
U.S.	-0.13
2016–2065	
Growth Rate	0.33
Change in Growth Rate	0.50
Growth with Drift	0.76
Growth	0.38
Change in Growth with Drift	1.21
Change in Growth	0.51
Mean	0.64
Median ★	0.51
U.S.	0.66

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift
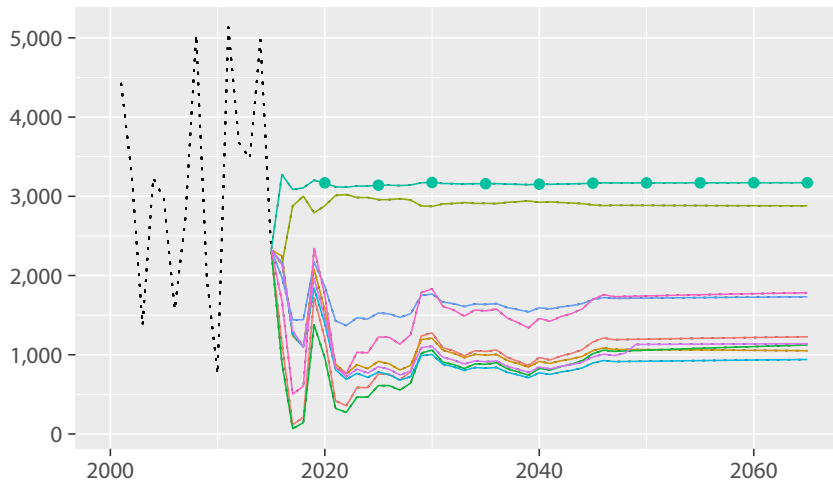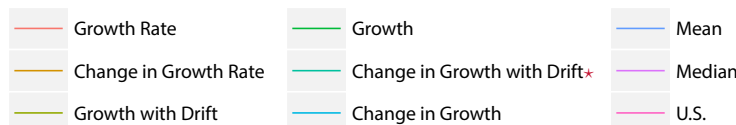- Change in Growth
- Mean
- Median ★
- U.S.

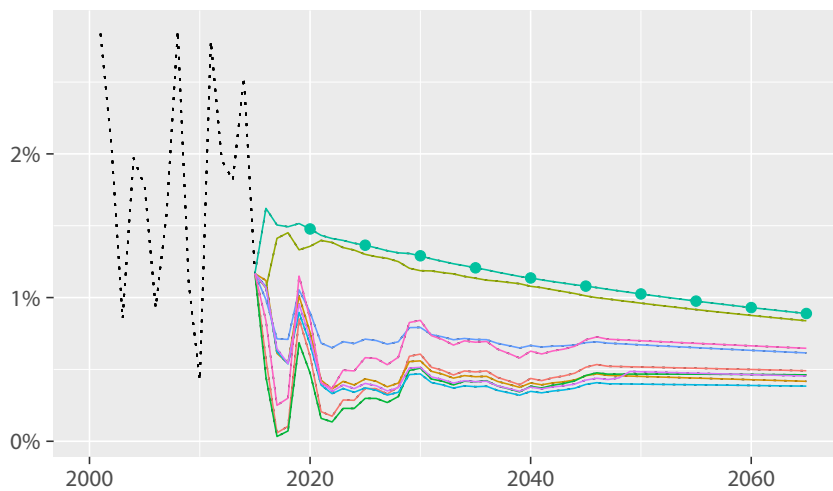# Projected Employment and Employment Growth 2016–2065
State and Local Government

Employment

Employment Growth

Employment Growth Rates

Legend: Growth Rate · Change in Growth Rate · Growth with Drift · Growth · Change in Growth with Drift★ · Change in Growth · Mean · Median · U.S.

Industry Description Activities within this sector may include those of any private-sector industry given elsewhere in this document, but are carried out by state- and local-government employees.
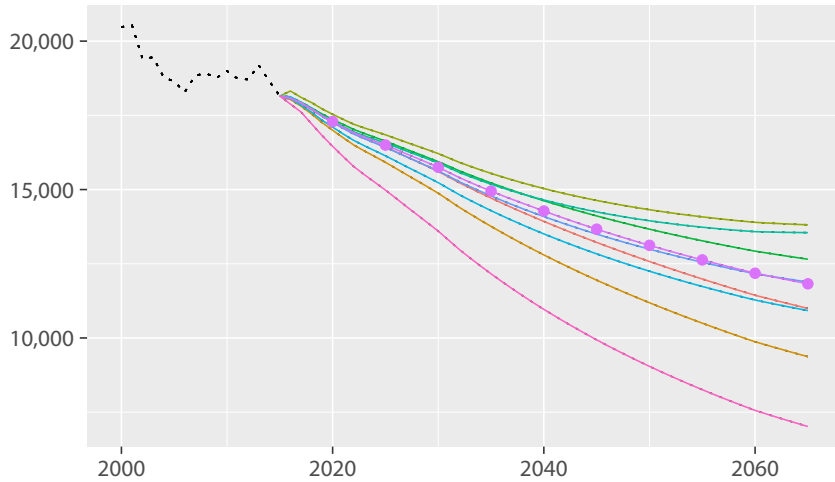
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	CAAGR %
2000–2015	
2000–2015	1.81
2016–2030	
Growth Rate	0.37
Change in Growth Rate	0.52
Growth with Drift	1.34
Growth	0.30
Change in Growth with Drift ★	1.42
Change in Growth	0.47
Mean	0.75
Median	0.50
U.S.	0.59
2016–2065	
Growth Rate	0.46
Change in Growth Rate	0.46
Growth with Drift	1.10
Growth	0.40
Change in Growth with Drift ★	1.17
Change in Growth	0.41
Mean	0.69
Median	0.45
U.S.	0.65

Projected Employment and Employment Growth 2016–2065
Farm

Employment

Employment Growth
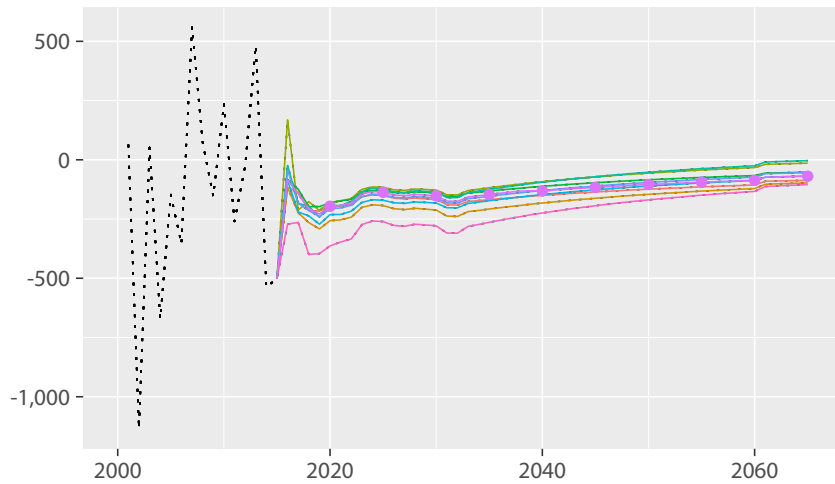
Employment Growth Rates

Legend:
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift
- Change in Growth
- Mean
- Median ★
- U.S.
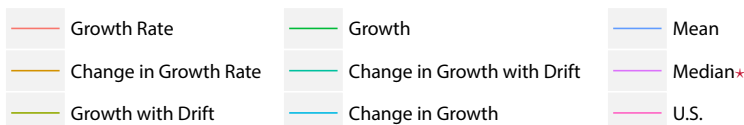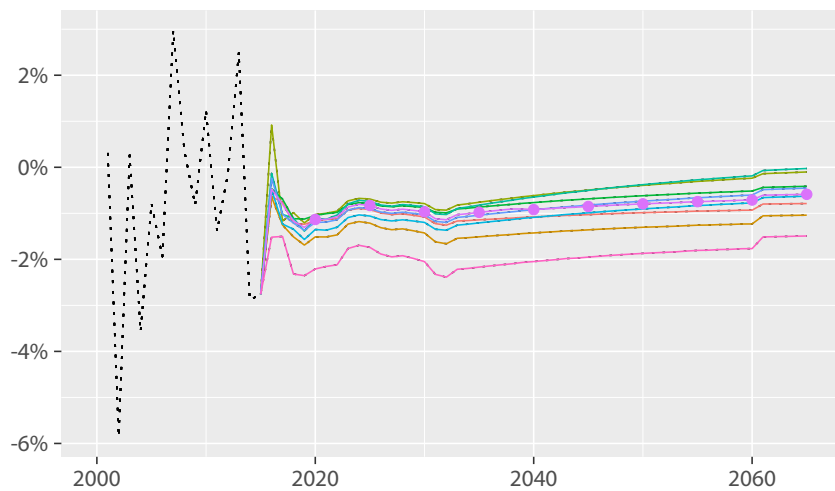
Industry Description According to the U.S. Bureau of Economic Analysis, Farm employment consists of "workers engaged in the direct production of agricultural commodities, either livestock or crops; whether as a sole proprietor, partner, or hired laborer."

About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, and a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S.
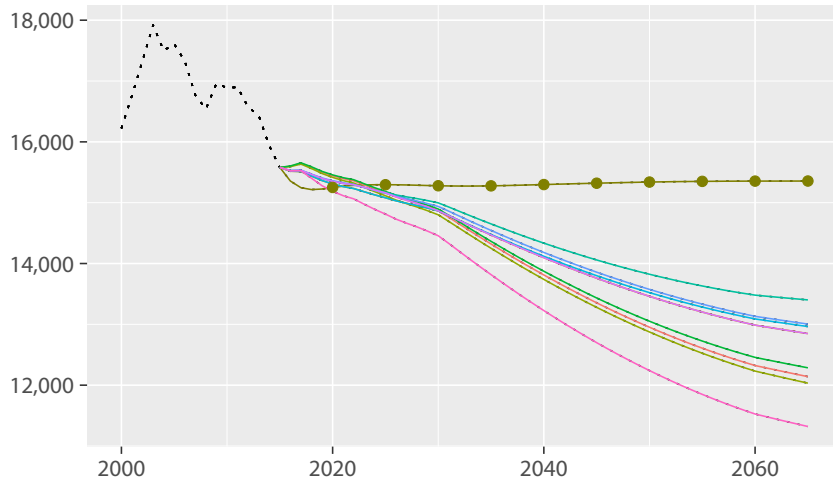
The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case the Median projection, is marked with dots in the graphs and a star in the legend and table.

	CAAGR %
2000–2015	
2000–2015	-0.80
2016–2030	
Growth Rate	-1.03
Change in Growth Rate	-1.37
Growth with Drift	-0.87
Growth	-0.89
Change in Growth with Drift	-0.93
Change in Growth	-1.21
Mean	-1.05
Median ★	-0.97
U.S.	-1.94
2016–2065	
Growth Rate	-1.00
Change in Growth Rate	-1.33
Growth with Drift	-0.57
Growth	-0.72
Change in Growth with Drift	-0.59
Change in Growth	-1.02
Mean	-0.86
Median ★	-0.86
U.S.	-1.89

Projected Employment and Employment Growth 2016–2065
Military

Employment

Employment Growth

Employment Growth Rates

Legend:
- Constant★
- Growth Rate
- Change in Growth Rate
- Growth with Drift
- Growth
- Change in Growth with Drift
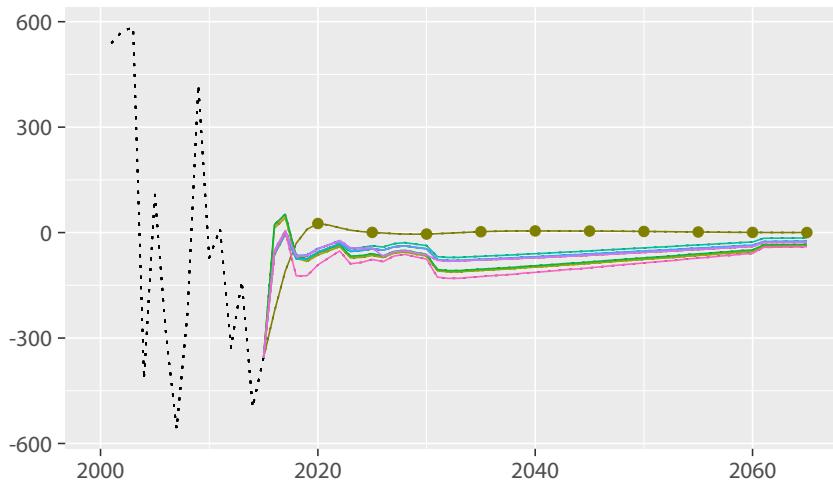- Change in Growth
- Mean
- Median
- U.S.
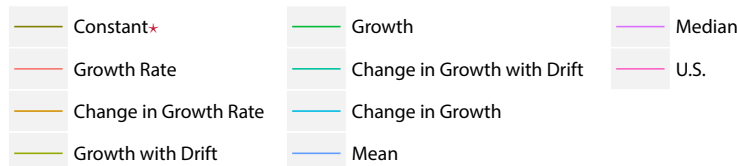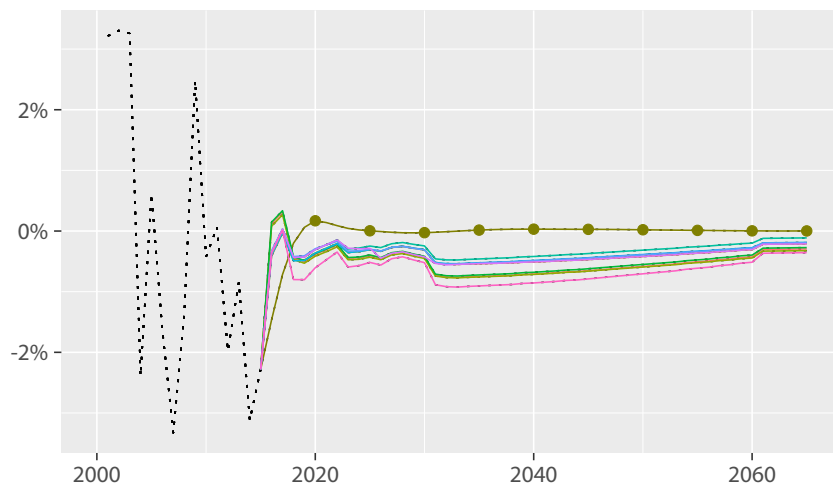
Industry Description According to the U.S. Bureau of Economic Analysis (BEA), Military employment consists of "personnel assigned to active duty units that are stationed in the area plus the number of military reserve unit members."

About the Figures and Table The three figures at left show historical and projected annual employment (top), employment growth (middle), and rates of employment growth (bottom) for each of the six models, their mean and median, a reference projection that shows what Utah employment would look like if it were to grow at the same rate as the U.S., and a "constant" projection.

The table below shows compounded average annual growth rates (CAAGR) for each of these. The projection chosen as the official statewide projection for this industry, in this case the Constant projection, is marked with dots in the graphs and a star in the legend and table.

Unlike the other industries, Military includes a projection that is nearly constant (Constant). This projection was chosen under expert judgement in a manner similar to that applied to other industries.

	CAAGR %
2000–2015	
2000–2015	-0.27
2016–2030	
Constant ★	-0.04
Growth Rate	-0.34
Change in Growth Rate	-0.31
Growth with Drift	-0.37
Growth	-0.33
Change in Growth with Drift	-0.25
Change in Growth	-0.31
Mean	-0.28
Median	-0.31
U.S.	-0.51
2016–2065	
Constant ★	0.00
Growth Rate	-0.51
Change in Growth Rate	-0.38
Growth with Drift	-0.53
Growth	-0.49
Change in Growth with Drift	-0.30
Change in Growth	-0.37
Mean	-0.36
Median	-0.39
U.S.	-0.64