**Data Visualization**

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Analyzing the Relationship between GDP, Per Capita, Population, and Employment trends in the US Over 2010 to 2021

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INTRODUCTION

The project aims to showcase an extensive dataset highlighting the economic progress and advancement of the United States between 2010 and 2021. The datasets contain crucial information such as GDP, Personal Income, Disposable Personal Income, Personal consumption expenditures, Per capita Personal Income, Per Capita disposable personal income, Per Capita personal consumption expenditures, total employment, and Population from various data sources. The primary objective of this project is to present this information in a user-friendly and comprehensible manner to enable the analysis of economic growth patterns and trends across various demographic categories and geographic locations. I have selected the relevant chart types and visualizations in Tableau.

This project is about analyzing the relationship between GDP, Per Capita, Population, and employment for the economic growth and development of the United States. As it has the world’s largest economy and consists of 50 states. Studying the economic metrics of individual states can offer a valuable understanding of the factors that support economic progress and advancement in the United States over the period of 2010 to 2021.

I have identified some key questions to answer before starting the project.

* What are the overall trends in GDP, personal income & Employment rate across all states in the US in 2021?
* What is the relationship between total population and Normalized employment in the US?
* What is the relationship between GDP, Personal Income, and Taxes in the US?
* What is the relationship between GDP income growth and Per capita Income growth across US states over 2010 – 2021?
* **Is there a correlation between total population and employment rate across US states? Is there a correlation between the GDP and the Per Capita Personal Income for the United States from 2010 to 2021?**

**METHODOLOGY**

**GDP Data:**

This Dataset contains data about the GDP, Personal Income, Disposable Personal Income, and Personal consumption expenditures of all the states in the US from 2010 to 2021.

**Per Capita Data:**

This Dataset contains data about the Per capita personal Income, Per capita disposable personal income, and Per capita personal consumption expenditures of all the states in the US from 2010 to 2021

**Employment Data:**

This Dataset contains the state-wise employment data in the United States from 2010 to 2021.

Data Source Link: The above datasets are extracted from the data source by the US Bureau of Economic Analysis

<https://apps.bea.gov/iTable/?reqid=70&step=1&acrdn=7#eyJhcHBpZCI6NzAsInN0ZXBzIjpbMSwyNCwyOSwyNSwzMSwyNiwyNywzMF0sImRhdGEiOltbIlRhYmxlSWQiLCI2MDAiXSxbIkNsYXNzaWZpY2F0aW9uIiwiTm9uLUluZHVzdHJ5Il0sWyJNYWpvcl9BcmVhIiwiMCJdLFsiU3RhdGUiLFsiMCJdXSxbIkFyZWEiLFsiWFgiXV0sWyJTdGF0aXN0aWMiLFsiLTEiXV0sWyJVbml0X29mX21lYXN1cmUiLCJMZXZlbHMiXSxbIlllYXIiLFsiLTEiXV0sWyJZZWFyQmVnaW4iLCItMSJdLFsiWWVhcl9FbmQiLCItMSJdXX0=>

**Population Data:**

This dataset contains the total population of all the states in the US from 2010 to 2021

Data Source Link: The above dataset is extracted from the data source by the US Census Bureau.

<https://www.census.gov/data/tables/time-series/demo/popest/2020s-state-total.html>

<https://www.census.gov/data/datasets/time-series/demo/popest/2010s-state-total.html>

All the data that has been utilized in this project can be found in the links mentioned above. The data has been preprocessed using Python scripts to make sure composite primary keys (state and year) are viable. Attaching the sample script below.



Table

Description automatically generated with low confidence

**ANALYSIS**

1. The average personal income in the United States for each individual state in 2021.

## 

The presented data visualization provides information on the average personal income of each state in the United States for the year 2021. A bar chart was selected for this visualization to enable easy comparison of the average personal income across states. Based on the chart, California has the highest average personal income, followed by Texas, New York, and Florida, while the lowest average personal income is observed in Vermont, Wyoming, Alaska, and North Dakota. Understandably, the top states have significantly higher average personal income. This causes them to become centers of trade, giving them an opportunity to grow even more in the future.

1. The percentage of employment rate for each individual state in the United States in the year 2021.

Chart, bubble chart

Description automatically generated

The data visualization presented displays the employment rate percentage for each state in the United States in the year 2021. To create this chart, a calculated field was used to determine the employment rate by calculating the percentage of total employment divided by the total population. The chosen chart type is a bubble chart, which allows for easy identification of the employment rate across states with the size of the bubble representing the total employment. The color gradient indicates the range of employment rate, from lower (lighter color) to higher (darker color). Based on the chart, California has an employment rate of 61.07%, followed by Texas with 61.83% and New York with 61.37%. States with the highest employment rates are displayed with darker bubbles in the center, including North Dakota with 72.80%, Wyoming with 70.61%, and South Dakota with 69.44%. It's important to note that the employment rate is directly related to both employment and population.

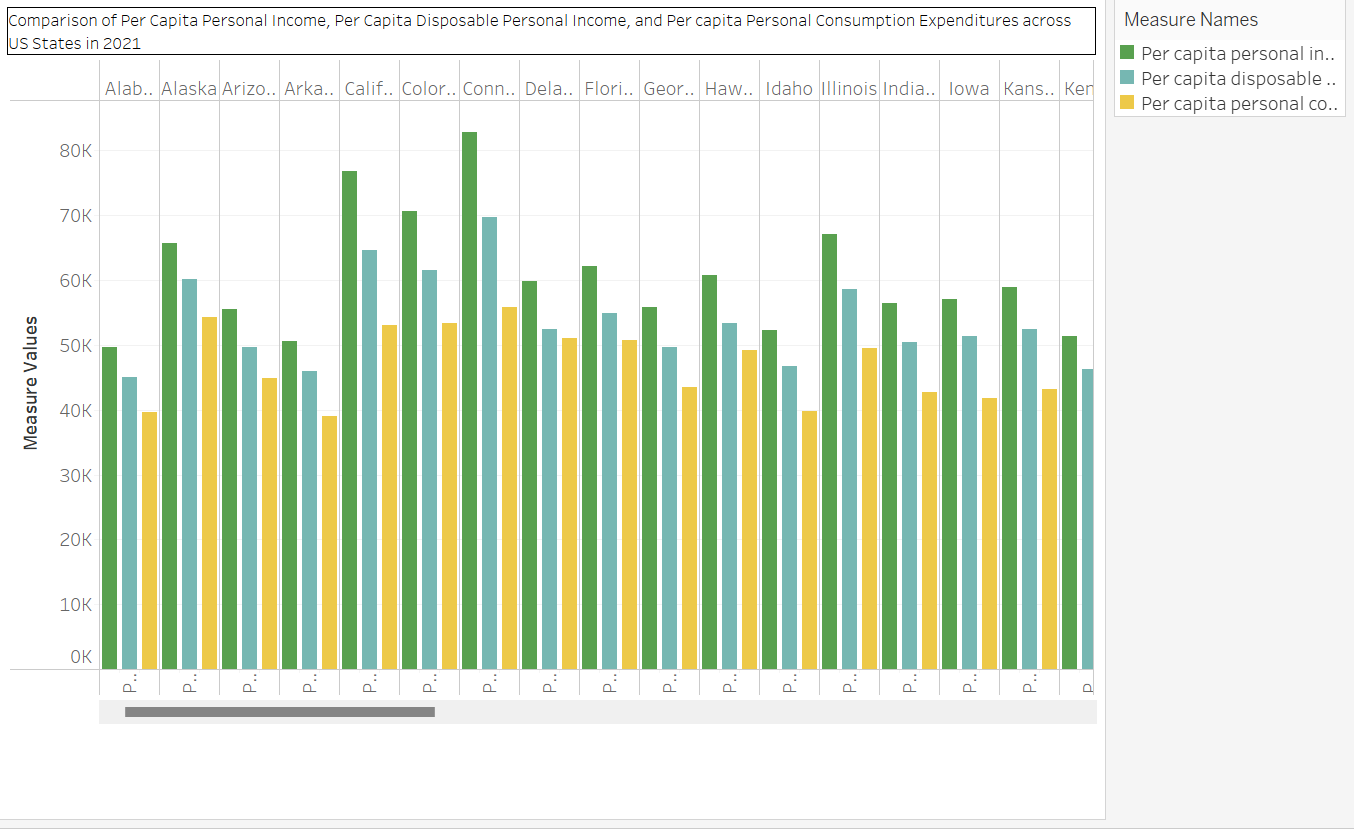
1. A comparison of the GDP, personal income, disposable personal income, and personal consumption expenditures among the various states of the United States in the year 2021.

Chart

Description automatically generated

The displayed data visualization compares the GDP, personal income, disposable personal income, and personal consumption expenditures of each state in the United States for the year 2021. To enable an easy comparison of these economic factors across states, a side-by-side bar chart was selected for this visualization. The chart uses an orange bar to represent GDP, a purple bar to represent personal income, a blue bar to represent disposable personal income, and a red bar to represent personal consumption expenditures. Based on the chart, California has the highest economic factors, followed by Texas and New York. This is most likely credited to these states having the highest employment rate, taking into consideration their population.

1. A comparison of per capita personal income, per capita disposable personal income, and per capita personal consumption expenditures among the various states of the United States in the year 2021.



The displayed data visualization compares the Per capita personal income, Per capita disposable personal income, and Per capita personal consumption expenditures of each state in the United States for the year 2021. To enable an easy comparison of these economic factors across states, a side-by-side bar chart was selected for this visualization. The chart uses a green bar to represent Per Capita personal income, a blue bar to represent Per Capita disposable personal income, and a yellow bar to represent per capita personal consumption expenditures. Based on the chart, Massachusetts, and Connecticut. Unlike GDP income growth, Per Capita income growth is divided by the total midyear population and was computed using Census Bureau midyear population estimates.

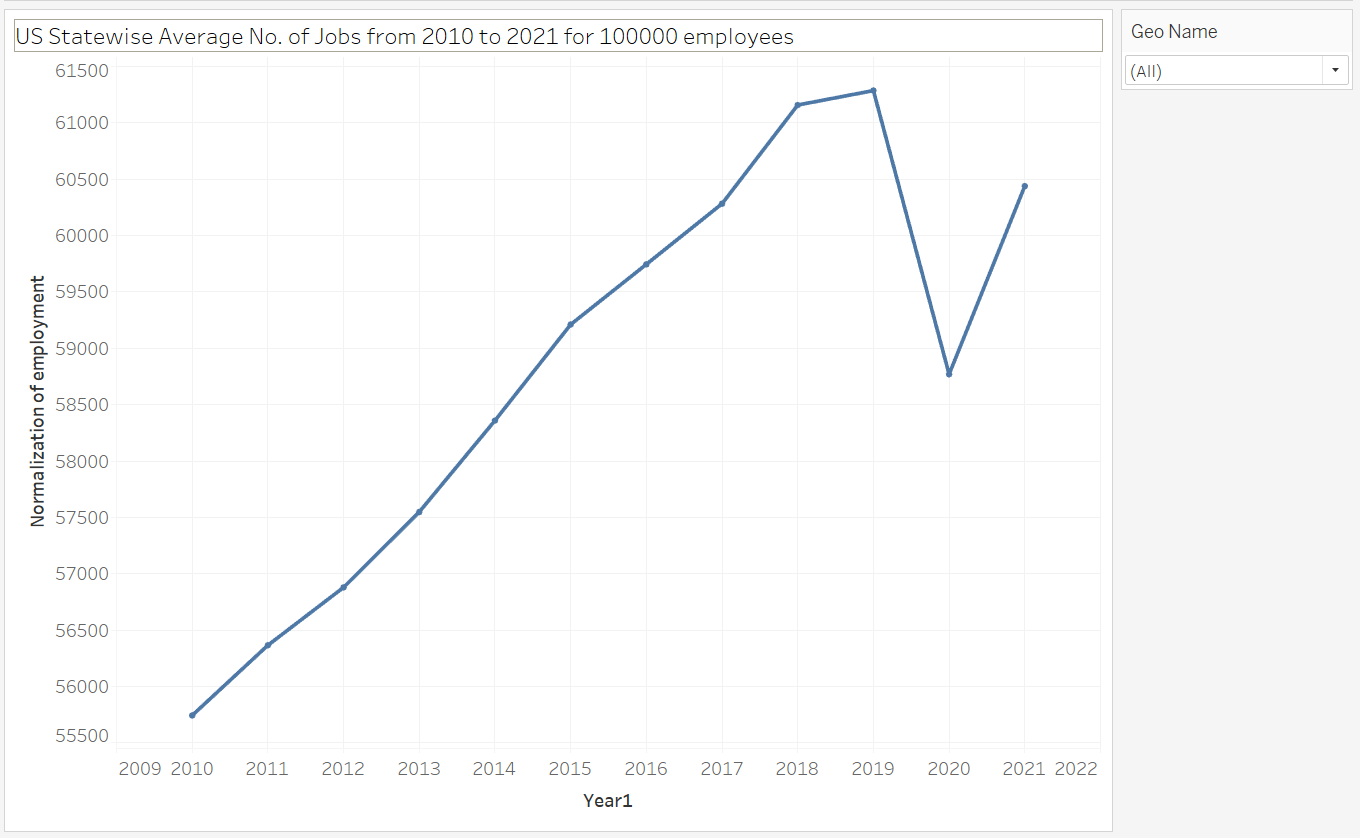
1. A comparison of the total population and employment rate with GDP among the various states of the United States in the year 2021.

Chart, scatter chart

Description automatically generated

The presented data visualization compares the total population, employment rate, and GDP of each state in the United States for the year 2021. A scatter plot was chosen to facilitate an easy comparison of these variables across states. The states are represented using different colors in the plot. The scatter plot displays a normal distribution for both population and GDP, with the state having the highest population having the highest GDP. However, the distribution of employment rates varies. In regions with high populations and high employment rates, the employment rate is high, and vice versa. The outlier in this case happens to be California, which has a comparatively high GDP.

1. The average number of jobs per 100,000 employees in each state of the United States from 2010 to 2021.



The displayed data visualization provides information on the average number of jobs for every 100,000 employees in each state of the United States from 2010 to 2021. A line chart was used to visualize the trends of the average number of employees across states. To normalize the number of employees, a field was created for the purpose of this project. The chart shows an increase in the number of employees from 2010 to 2019, followed by a decline in 2020 due to external factors such as the COVID-19 pandemic, and a subsequent increase in 2021. A filter has been enabled to allow the selection of different states to display the number of employees for the selected state.

1. Time series trends of the total population in each state of the United States from 2010 to 2021.

Chart, bar chart

Description automatically generated

The displayed data visualization provides information on the total population in each state of the United States from 2010 to 2021. A Bar chart was used to visualize the time series trends of the total population across states. The chart shows an exponential increase in the number of employees from 2010 to 2019, followed by a decline in 2020 due to external factors such as the COVID-19 pandemic for some states, and a subsequent increase in 2021. A filter has been enabled to allow the selection of different states to display the total population for the selected state. The color gradient indicates the range of total employment from lower (lighter color) to higher (darker color) from 2010 to 2021.

1. Time series trends of the total GDP in each state of the United States from 2010 to 2021.

Chart, line chart

Description automatically generated

The displayed data visualization provides information on the total gross domestic product in each state of the United States from 2010 to 2021. A line chart was used to visualize the trends of the total gross domestic product across states. The chart shows an increase in the GDP from 2010 to 2019, followed by a decline in 2020 due to external factors such as the COVID-19 pandemic, and a subsequent increase in 2021. A filter has been enabled to allow the selection of different states to display the total gross domestic product for the selected state.

1. Analyzing the time series of total personal income and tax across US states from 2010 to 2021.

Chart

Description automatically generated with medium confidence

This data visualization displays the trends of average personal income and average taxes in each state of the United States from 2010 to 2021. The chart utilizes a line chart format to make it easy to compare the average personal income and average taxes across states. To calculate the taxes, a calculated field is created by subtracting disposable personal income from personal income. The chart shows a significant increase in both personal income and taxes from 2010 to 2021. Here, the red line represents the personal income and orange line represent the tax. The chart allows users to filter and select different states to view the average personal income and average taxes for the selected state.

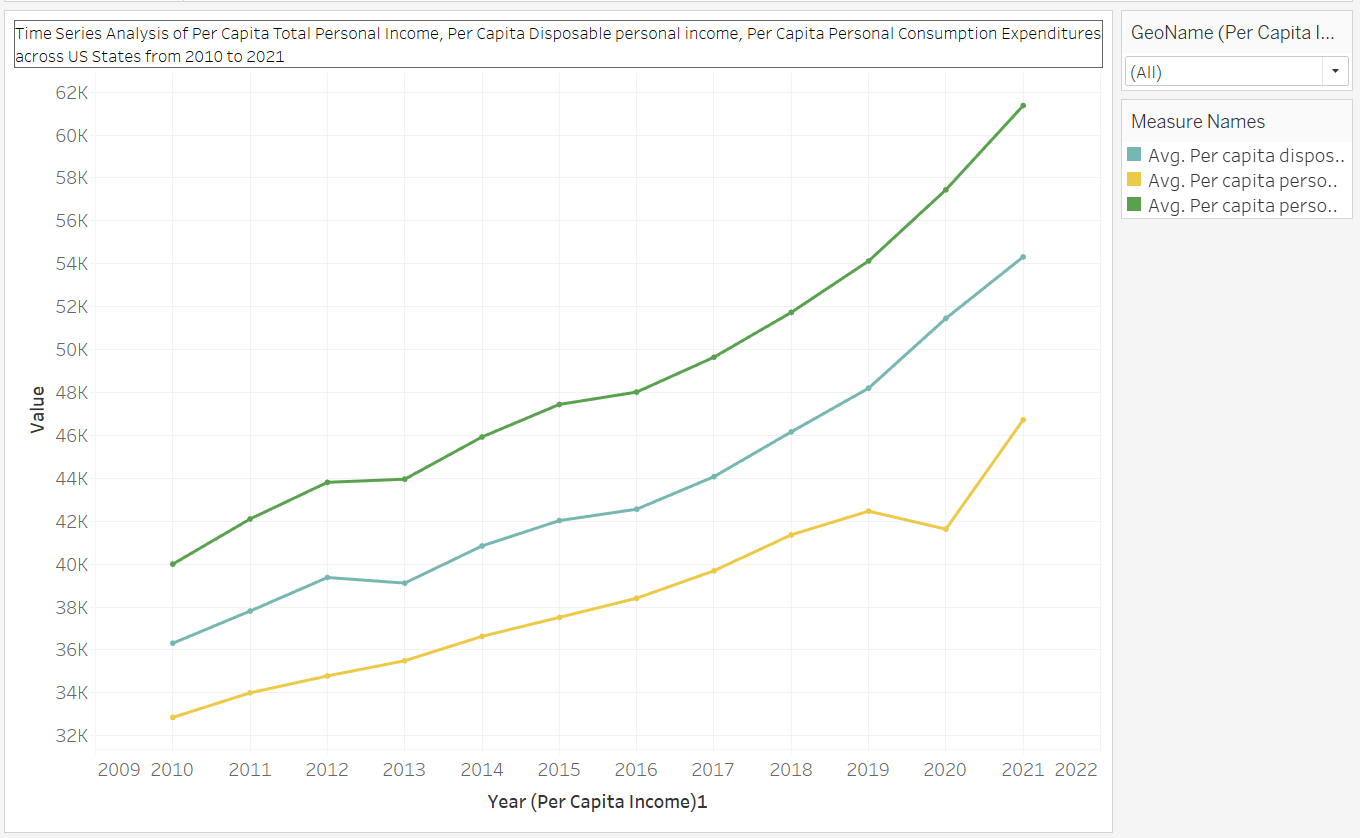
1. Analysis of Time Series Trends in Total Personal Income, Disposable Personal Income, and Personal Consumption Expenditures across US States from 2010 to 2021.

Chart, line chart

Description automatically generated

The presented data visualization compares the Personal Income, Disposable Personal income, personal consumption expenditures(PCE) across individual state in the United States from 2010 to 2021. Here the red line represents the personal income, blue line displays the disposable personal income, and orange line represents the personal consumption expenditure. The correlation between these demographics seems obvious by looking at the graph. Over the period, both incomes are aligned with each other. While the PCE has a good rise from 2010 to 2019, and a little decline in 2019 and in 2021 it is rising again. PCE depends on consumer spendings. A filter has been enabled to allow the selection of different states to display the GDP growth factors for the selected state.

1. Analysis of Per Capita Total Personal Income, Disposable Personal Income, and Personal Consumption Expenditures in US States from 2010 to 2021.



The displayed data visualization compares the per capita total personal income (PPI) , per capita disposable personal income (PDPI), and per capita personal consumption expenditures (PPCE) across individual states in the United States from 2010 to 2021. The green line represents the PPI , the blue line displays the PDPI, and the yellow line represents the PPCE. Over the period, both PPI and PDPI are aligned with each other. The PPCE is influenced by consumer spending. Hence, even though there is a significant increase in its numbers from 2010 to 2019, there was a slight decline in 2020 due to external factors such as the COVID-19 pandemic, followed by an increase again in 2021. A filter has been enabled to allow the selection of different states to display the Per capita growth factors for the selected state.

1. Correlation between Total Population and Employment Rate Across US States with Year Filter.

Chart, scatter chart

Description automatically generated

The above data visualization displays a correlation between the total population and the employment rate across different states in the United States. A scatter plot was utilized to enable a simple comparison of these variables. Understandably, the distribution of employment rate is normally distributed. Each state is represented by a differently colored point on the plot. In the year 2021, all the data points are distributed within the 50% to 70% range. This indicates that despite the variations in population sizes among the states, most of them have similar employment rates within this range. Here, a filter year is used to check the comparison between the population and employment rate for different years.

1. The correlation between the GDP and the Per Capita Personal Income for the United States from 2010 to 2021.

Chart, scatter chart

Description automatically generated

The presented data visualization is to corelate the total GDP with the per capita income across different states in the United States. A scatter plot was utilized to enable a simple comparison of these variables. Each state is represented by a differently colored point on the plot. From the chart, it can be observed that California has the highest GDP, but Massachusetts and Connecticut have the highest per capita personal income. In general, states with higher GDP tend to have higher per capita personal income since a larger economic output can support higher wages and salaries. However, the relationship between these two measures is not always one-to-one, and there can be variations based on factors such as income inequality, the composition of the economy, and the cost of living.

1. A map of the United States that shows the number of employed individuals per 100,000 people in each state as of 2021.

Map

Description automatically generated

The data visualization focuses on the number of employees per 100,000 people, which has been normalized for comparison purposes. To depict this information in a geographically clear and comprehensible manner, a map chart has been utilized. The employment data is presented using a color gradient, with darker areas indicating higher employment and lighter areas representing lower employment.

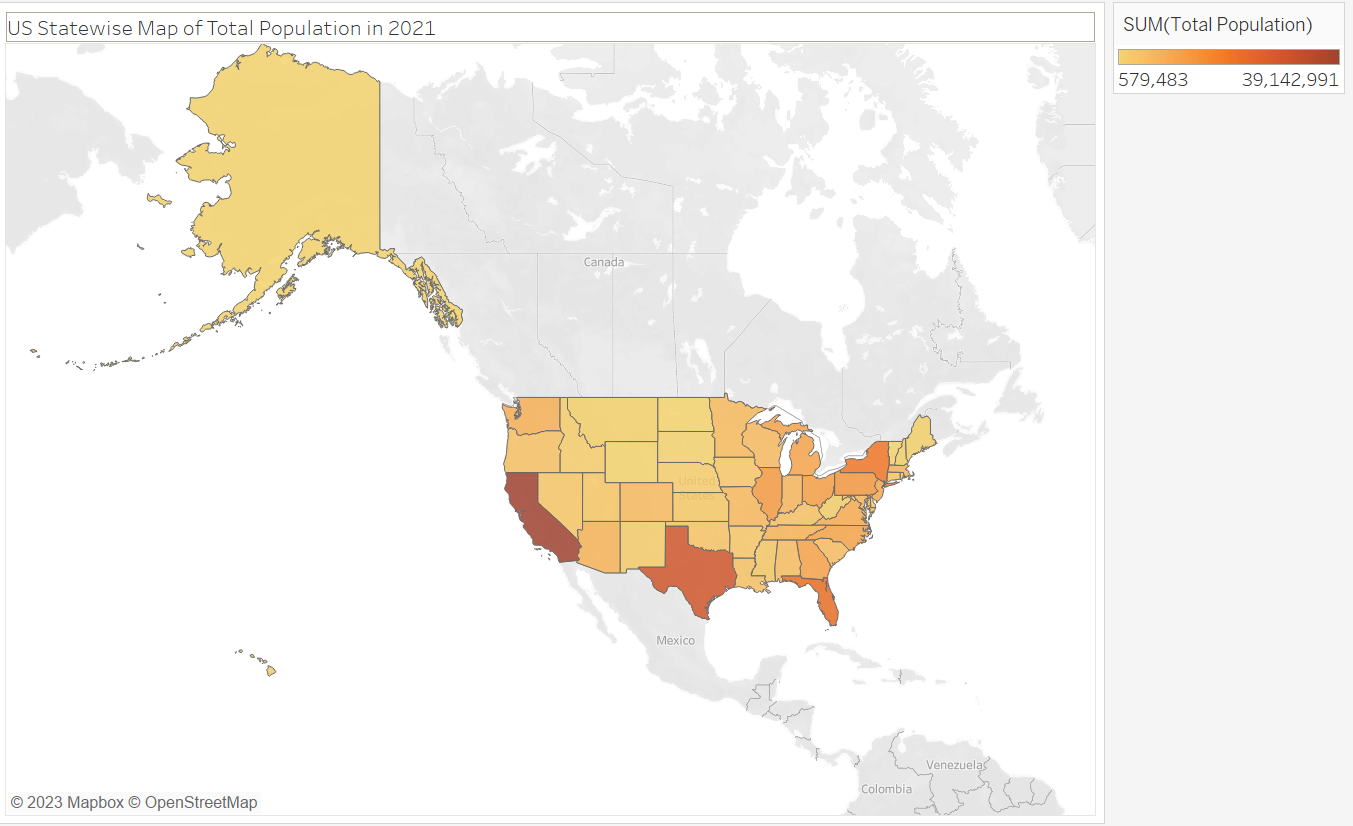
1. A map of the United States that shows the employment rate and GDP across each state in 2021.

Map

Description automatically generated

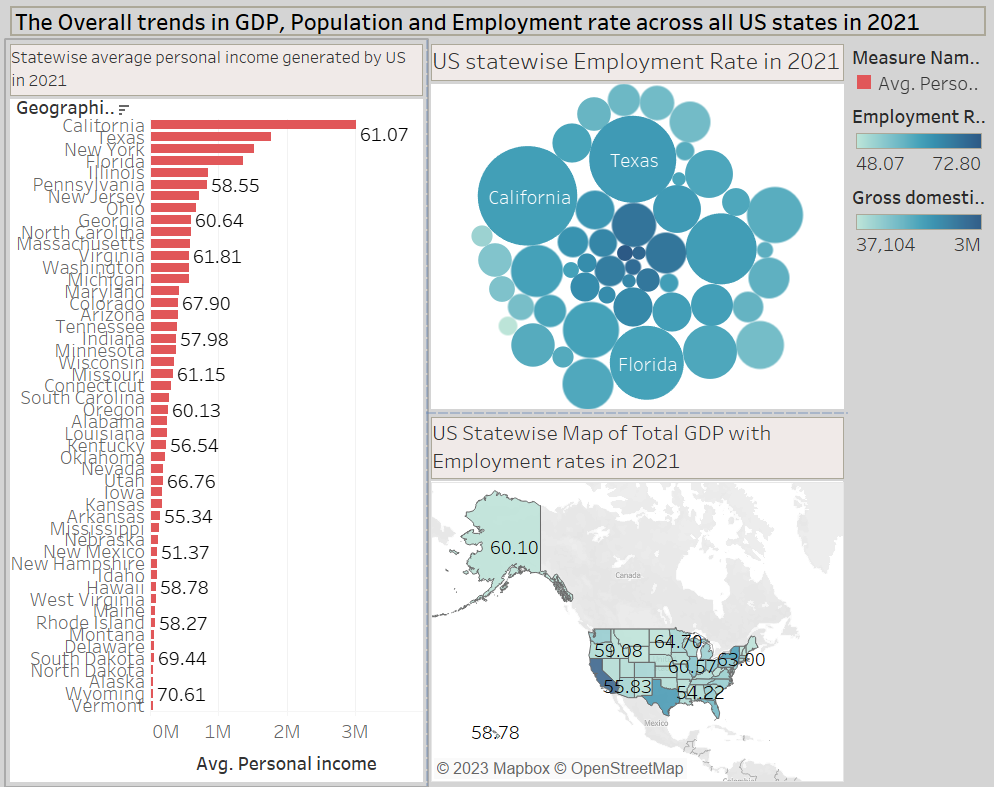
The data visualization focuses on the GDP and employment rate for the year 2021. To depict this information in a geographically clear and comprehensible manner, a map chart has been utilized. The GDP data is presented using a color gradient, with darker areas indicating higher GDP and employment rate and lighter areas representing lower GDP and employment rate.

1. A map of the United States that shows the total population across each state in 2021.



The data visualization focuses on the total population for the year 2021. To depict this information in a geographically clear and comprehensible manner, a map chart has been utilized. The total population data is presented using a color gradient, with darker areas indicating higher population and lighter areas representing lower population. From the above Map chart, it can be easily understood that California has the highest population followed by Texas and New York and Florida.

Dashborad1 : What are the overall trends in GDP, personal income & Employment rate across all states in US in 2021?



The Tableau Dashboard above illustrates the general patterns between personal income, employment rate, and GDP for each state in the United States in 2021. It presents the average personal income, employment rate percentage, and GDP for each state. The dashboard is interactive and allows users to select a specific state to view its data.

Dashboard2 : What is the relationship between total population and Normalized employment in the US?

Graphical user interface, application

Description automatically generated

The Tableau dashboard showcases the correlation between the total population and the normalized employment rate in the United States. The dashboard features two time-series charts, one each for population and employment in the US, and includes a filter option that enables users to choose any state of interest and analyze its data. This interactive dashboard offers users the flexibility to select a particular state and explore its information.

Dashboard3 : What is the relationship between GDP, Personal Income and Taxes in US?

Chart, line chart

Description automatically generated

The presented Dashboard demonstrates the correlation between GDP, personal income, and taxes in the United States. It features two data visualizations that include a time-series trend of GDP and time-series trends of personal income and taxes. The variables in the dashboard are interconnected; a rise in GDP leads to an increase in both personal income and taxes. The Dashboard also includes a filter option that enables users to choose any state of interest and analyze its data. This interactive dashboard provides users with the flexibility to select a particular state and explore its data.

Dashboard4 : What is the relationship between GDP income growth and Per capita Income growth across US states over 2010 – 2021?

Graphical user interface, application

Description automatically generated

The Dashboard presented showcases the relationship between GDP income growth and per capita income growth in the United States. The dashboard features two data visualizations; a time-series trend of GDP income growth and a time-series trend of per capita income growth. The dashboard includes a filter option that enables users to select a particular state and analyze its data. This interactive dashboard provides users with the flexibility to explore a state's data of interest. It's worth noting that the per capita data is calculated periodically by the census bureau, and it's based on the state's population.

CONCULSION

The trends in GDP, personal income, and employment rate across all states in the US in 2021 were generally positive, with a strong correlation between GDP and personal income, as well as between GDP and employment rate. While the relationship between total population and normalized employment was also positive, it was not as strong as the relationship between GDP and personal income or employment rate. Looking specifically at the period of 2010-2021, there was a positive correlation between GDP income growth and per capita income growth across US states, although there was significant variation between states. The correlation between total population and employment rate was also positive, but not as strong as the correlation between GDP and personal income and employment rate.

Here are some additional details:

* The states with the highest GDP in 2021 were California, Texas, New York, Florida, and Illinois.
* The states with the highest Per capita personal income in 2021 were Massachusetts, Connecticut, New York, New Jersey, and California.
* The states with the highest employment rate in 2021 were Vermont, Wyoming, Nebraska, South Dakota, and North Dakota.
* The states with the lowest GDP in 2021 were Vermont, Wyoming, Montana, South Dakota, and North Dakota.
* The states with the lowest personal income in 2021 were Vermont, Wyoming, Alaska, South Dakota, and North Dakota.
* The states with the lowest employment rate in 2021 were Mississippi, West Virginia, Arkansas, Alabama, and New Mexico.

Future Research Questions:

* Which industries or sectors of the economy have contributed the most to GDP growth and Employment growth in different US states? Are there any notable differences between states in this regard?
* What are the long-term effects of inflation on the US economy?
* What are the long-term effects of the recession of 2008 on the US economy?