# Exploring the Relationships Between GDP, Life Expectancy

# Project Objectives:

- Complete a project to add to your portfolio

- Use seaborn and Matplotlib to create visualizations

- Become familiar with presenting and sharing data visualizations

- Preprocess, explore, and analyze data

# Prerequisites:

- Data Acquisition

- Data Visualization

- Hypothesis Testing

- Summarizing Quantitative Data

- Data Wrangling and Tidying

- Data Manipulation with Pandas

# **Focusing Questions**:

- Has life expectancy increased over time in the six nations?
- Has GDP increased over time in the six nations?
- Is there a correlation between GDP and life expectancy of a country?
- What is the average life expectancy in these nations?
- What is the distribution of that life expectancy?

**GDP Source:** World Bank national accounts data, and OECD National Accounts data files.

**Life expectancy Data Source:** World Health Organization

# Exploratory Plots of GDP

Exploring data through plots can sometimes be much more effective, below the distribution of GDP is being shown. The distribution of GDP in the data is very right skewed where most of the values are on the left-hand side. This type of distribution could be described as a power law distribution, which is a common enough distribution that it has its own name. More about the power law can be read <u>here</u>
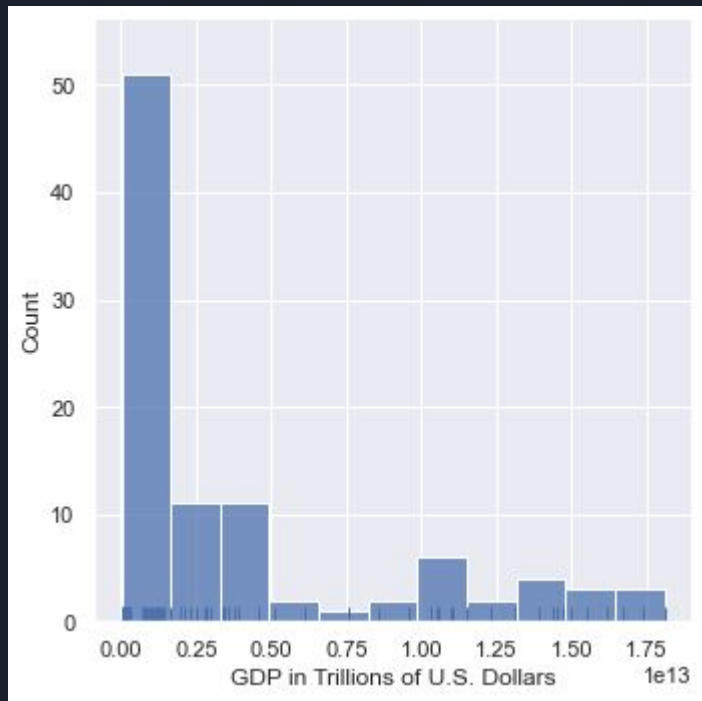
# Exploratory Plots of LEABY

Next the distribution of LEABY was examined. The distribution of LEABY in the data is very left skewed where most of the values are on the right-hand side. This is almost the opposite of what was observed in the GDP column. A further look might also identify different modes or smaller groupings of distributions within the range.
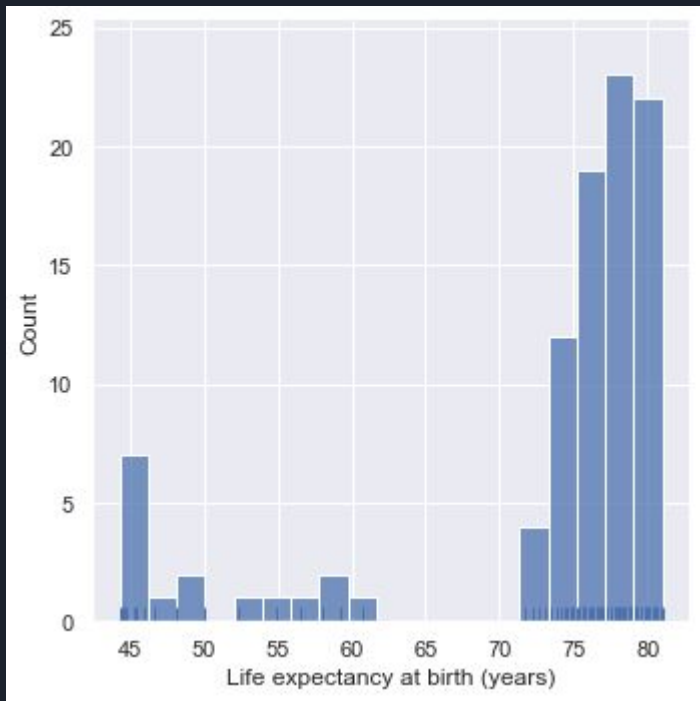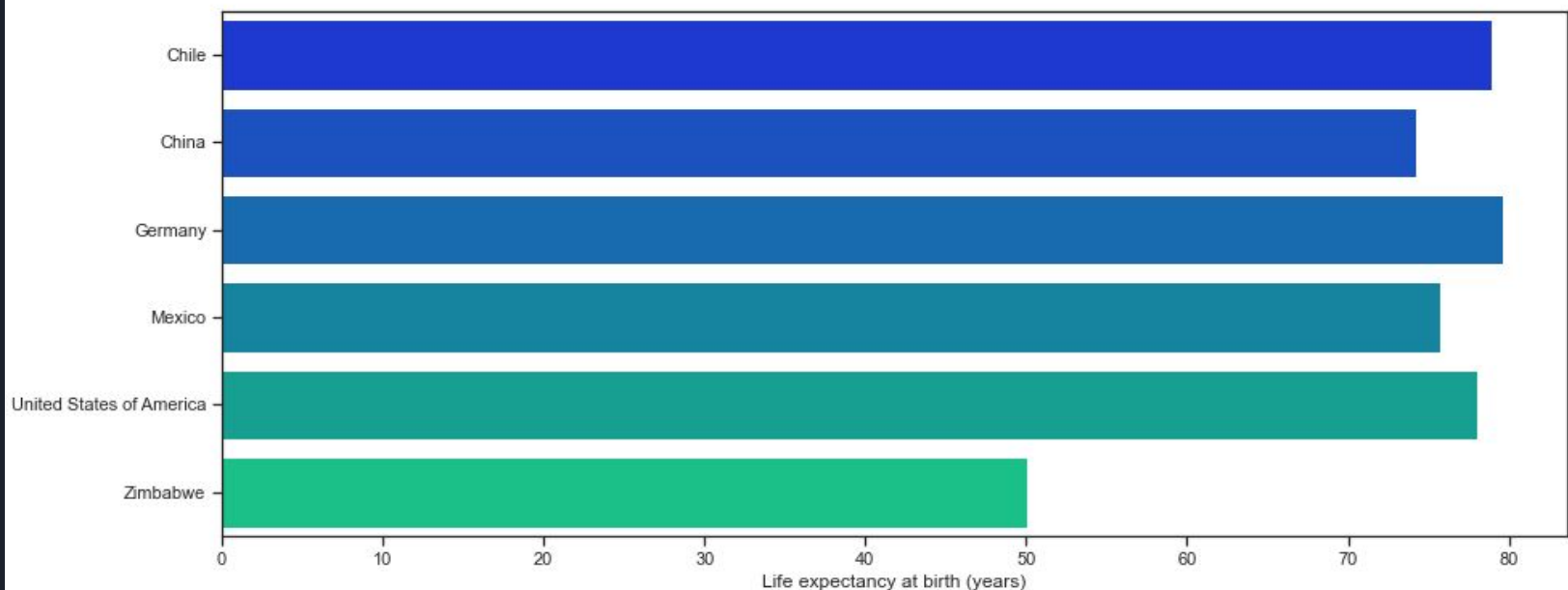
# GDP over time

For the average GDP by `Country` it seems that the US has a much higher value compared to the rest of the countries. In this bar plot, Zimbabwe is not even visible where Chile is just barely seen. In comparison the USA has a huge GDP compared to the rest. China, Germany and Mexico seem to be relatively close in figures.
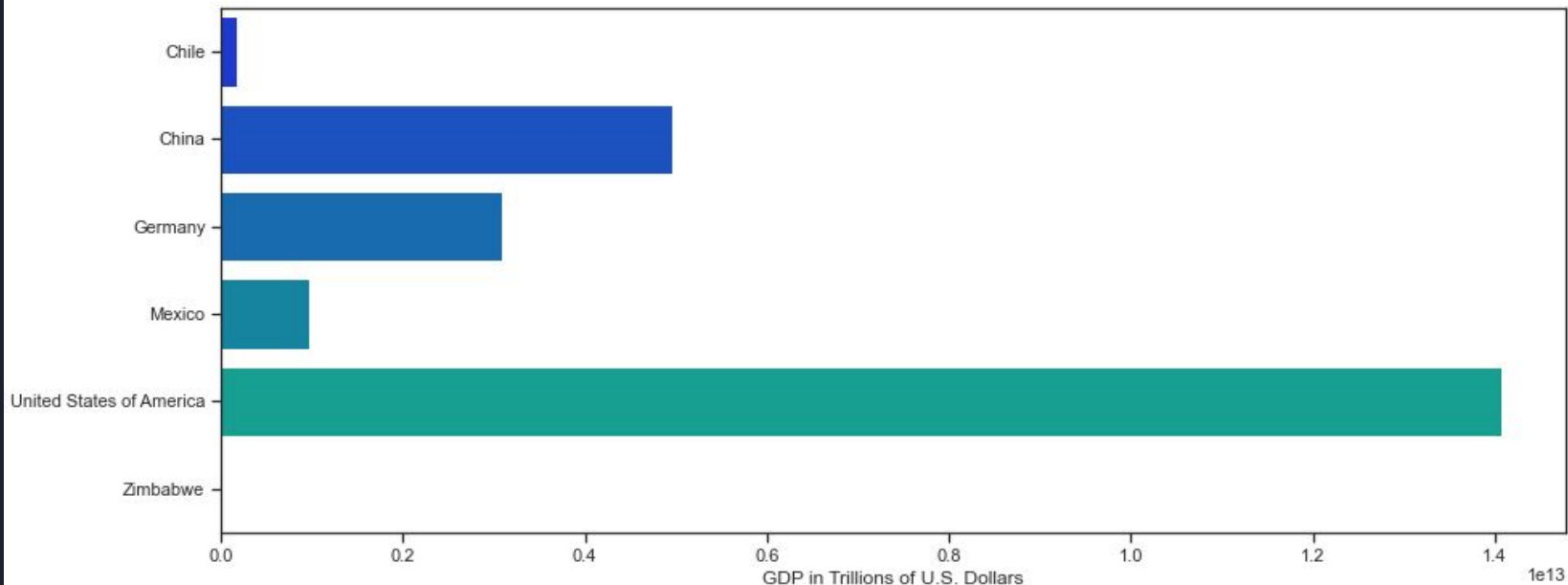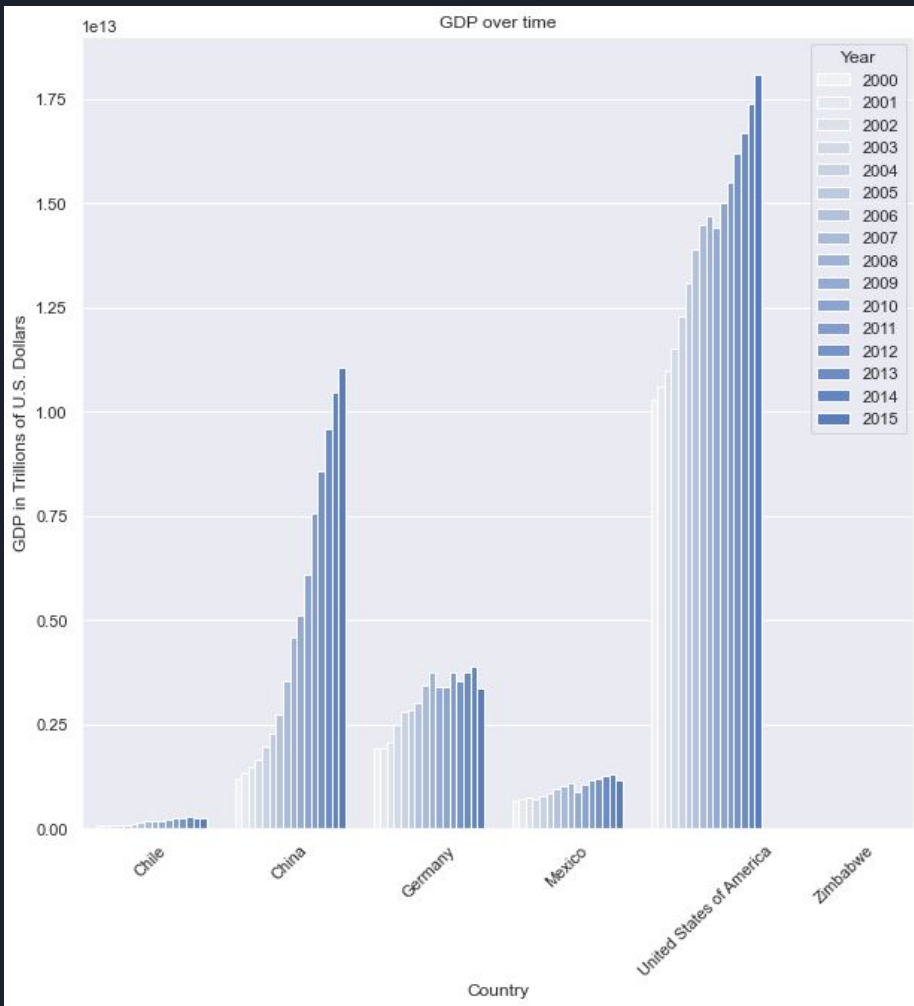
# Life expectancy over time

The first plot is Life Expectancy and all of the countries except for Zimbabwe have values in the mid-to-high 70s. This probably explains the skew in the distribution from before!
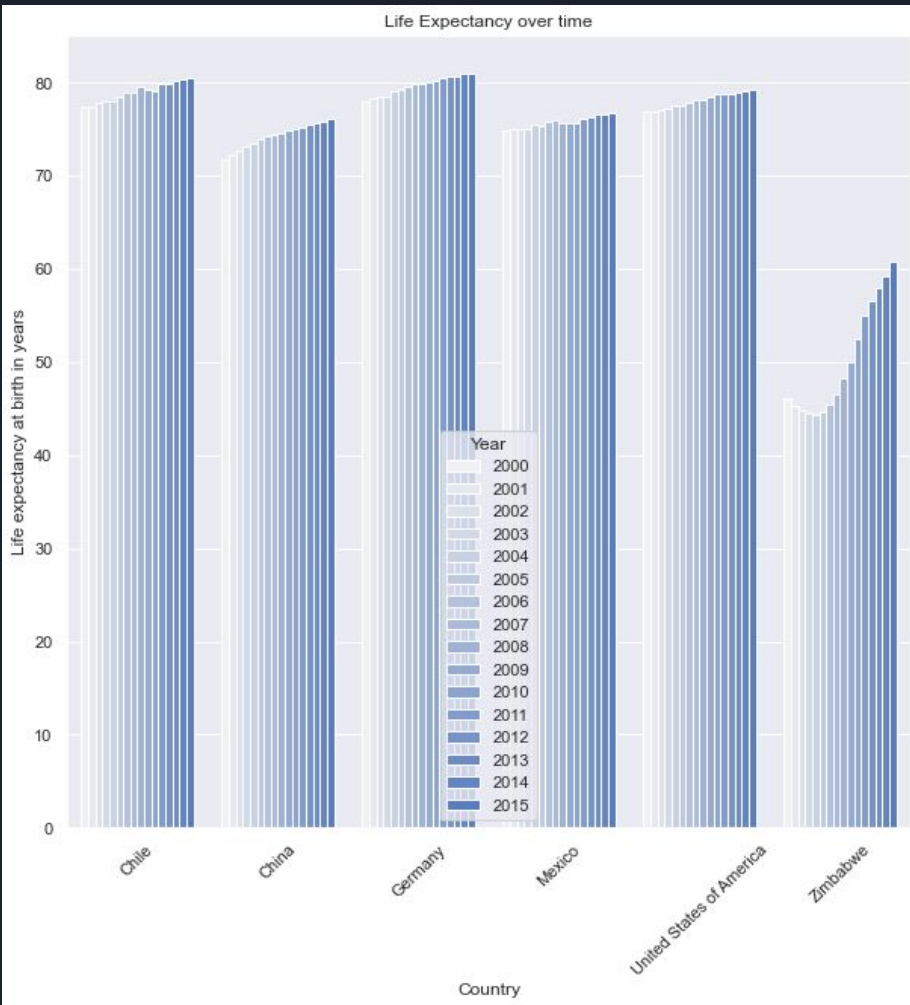
GDP over time

# Bar Plots Of GDP by Years

- The country with the most significant changes in GDP over time is China.
- The years with the biggest changes in GDP are from 2009 to 2011.
- Zimbabwe has had the least change in GDP over time.
- When comparing the countries in terms of GDP, the United States has a significantly higher value compared to the rest, while China, Germany, and Mexico appear relatively close in figures.

# Bar Plots Of Life Expectancy by Years

- Zimbabwe has experienced the most significant increase in life expectancy over time.
- The years with the biggest changes in life expectancy are not specified in the given information.
- The relationship between GDP and life expectancy is not clearly visible from the provided bar charts.
- Factors contributing to the data patterns for specific countries can include improvements in healthcare, social programs, and international aid efforts.
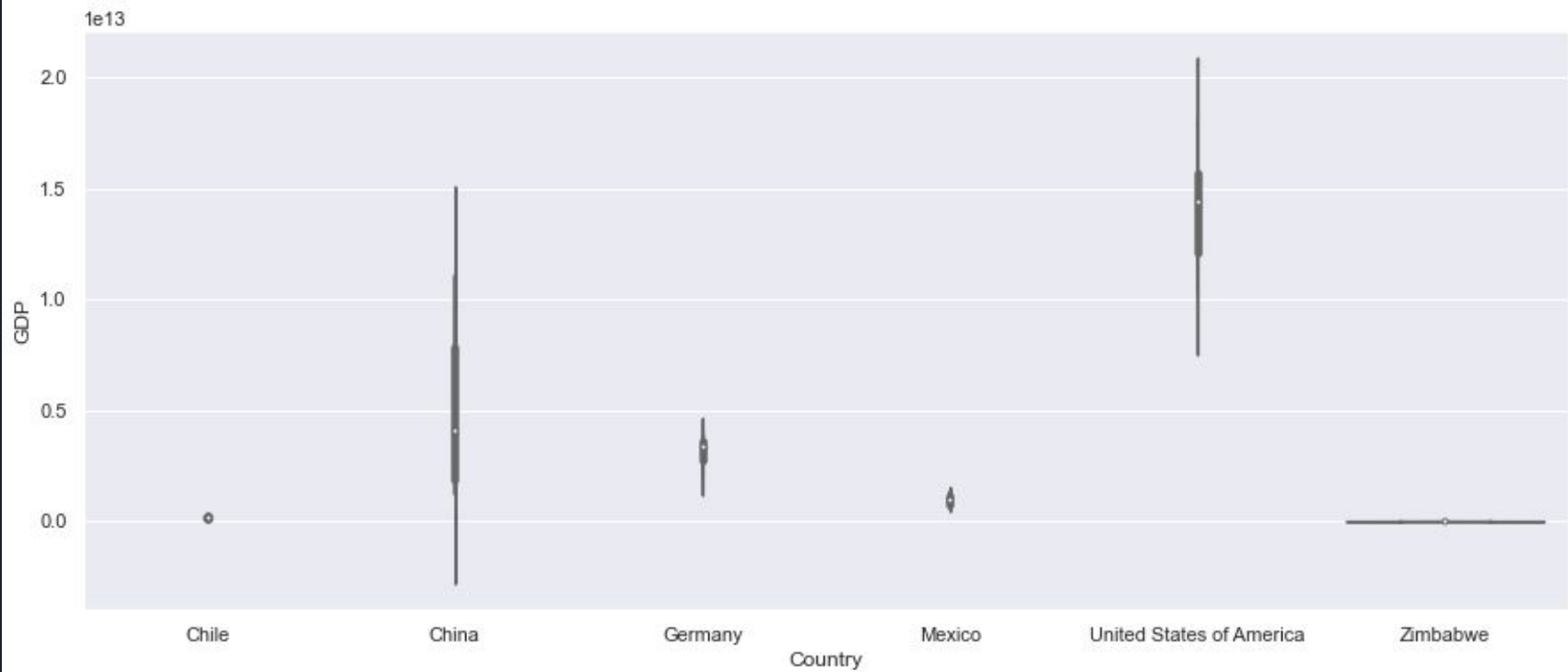
# Violin plot of Life expectancy over time

In the LEABY   plot, many of the countries have shorter ranges except for Zimbabwe which has a range spanning from the high 30s to the high 60s.
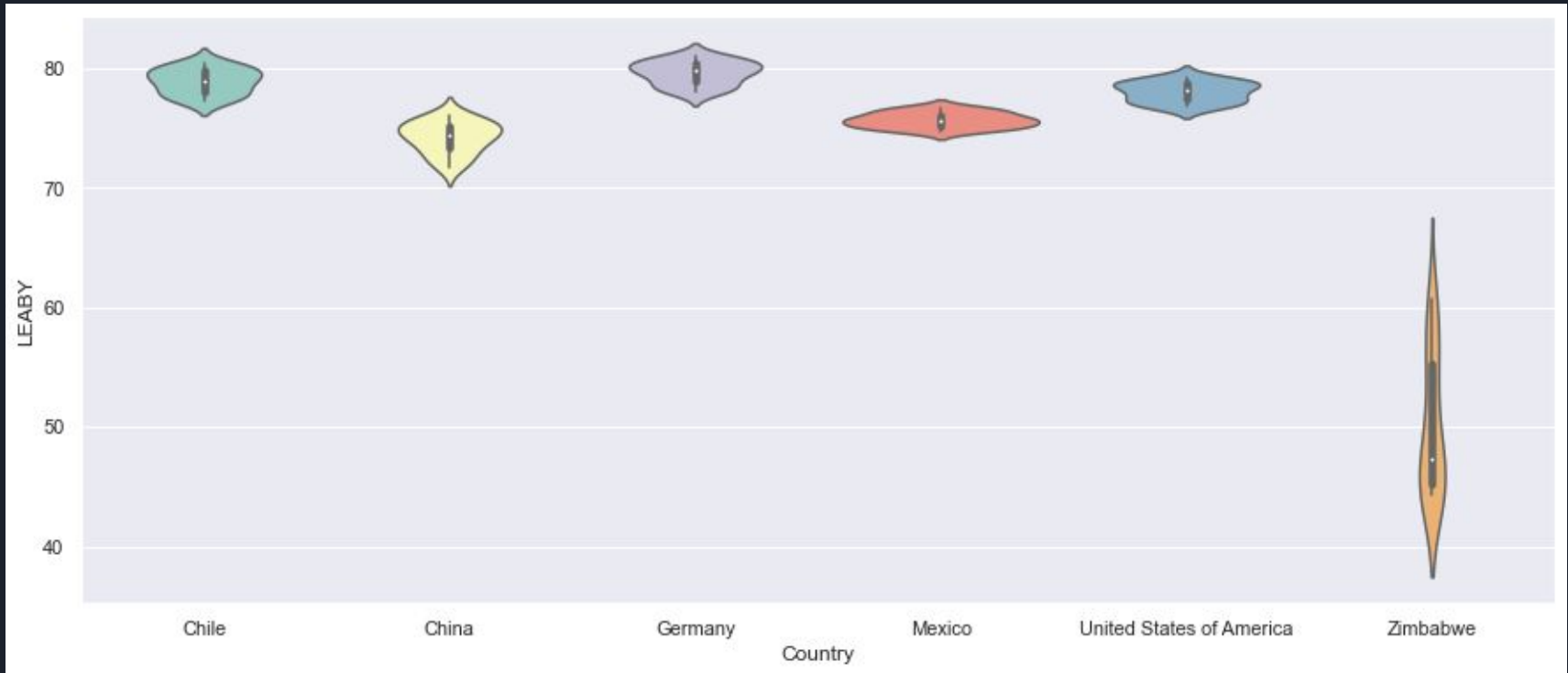
# Violin plot of GDP over time

In the GDP plot, China and the US have a relatively wide range, where Zimbabwe, Chile, and Mexico have shorter ranges.

# Swarm Plots

Another newer method for showing distributions is the swarm plot, and they can be used to complement the box and violin plots. First the stand alone swarm plot is shown and then overlaid on top of a violin plot. Swarm plots are useful because they show dot density around the values as well as distribution through area/shape.
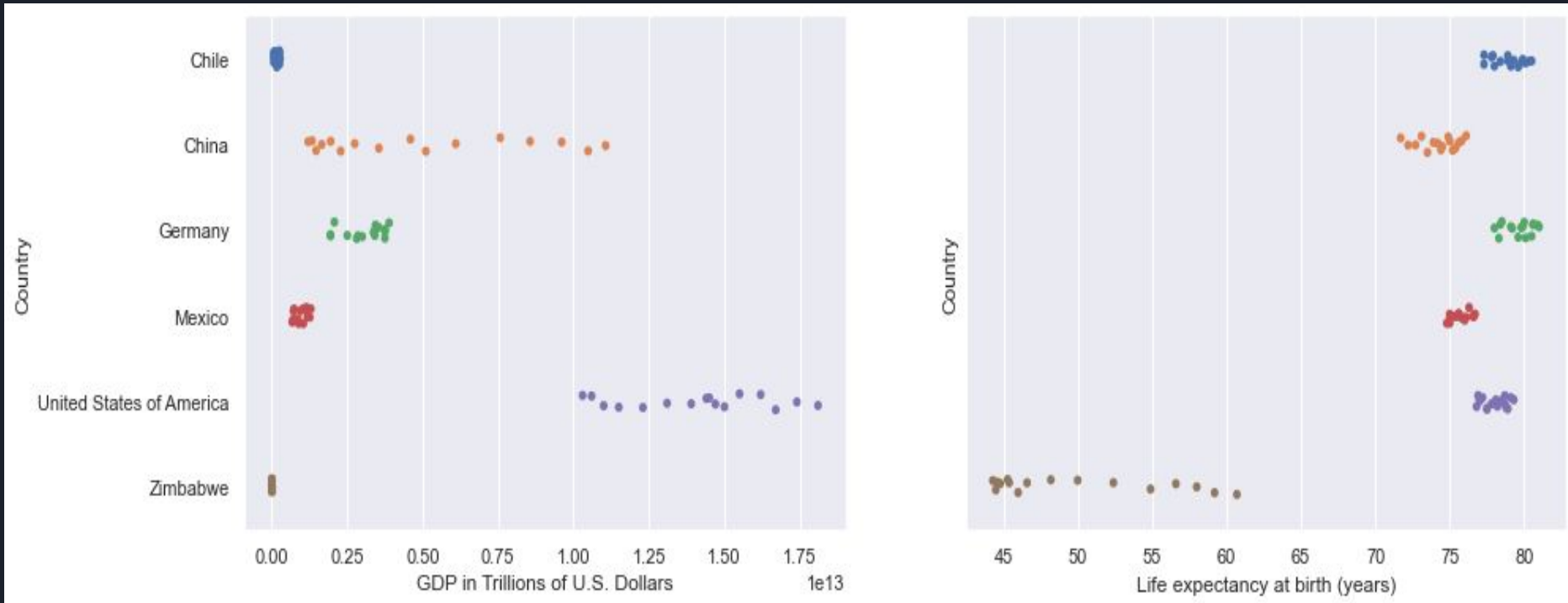
# Swarm Plots and Violin Plots

In the case of of the GDP plot on the left, Chile and Zimbabwe have a vertical line of dots that illustrate the number of data points that fall around their values. This detail would have been lost in the box plot, unless the reader is very adept at data visualizations.
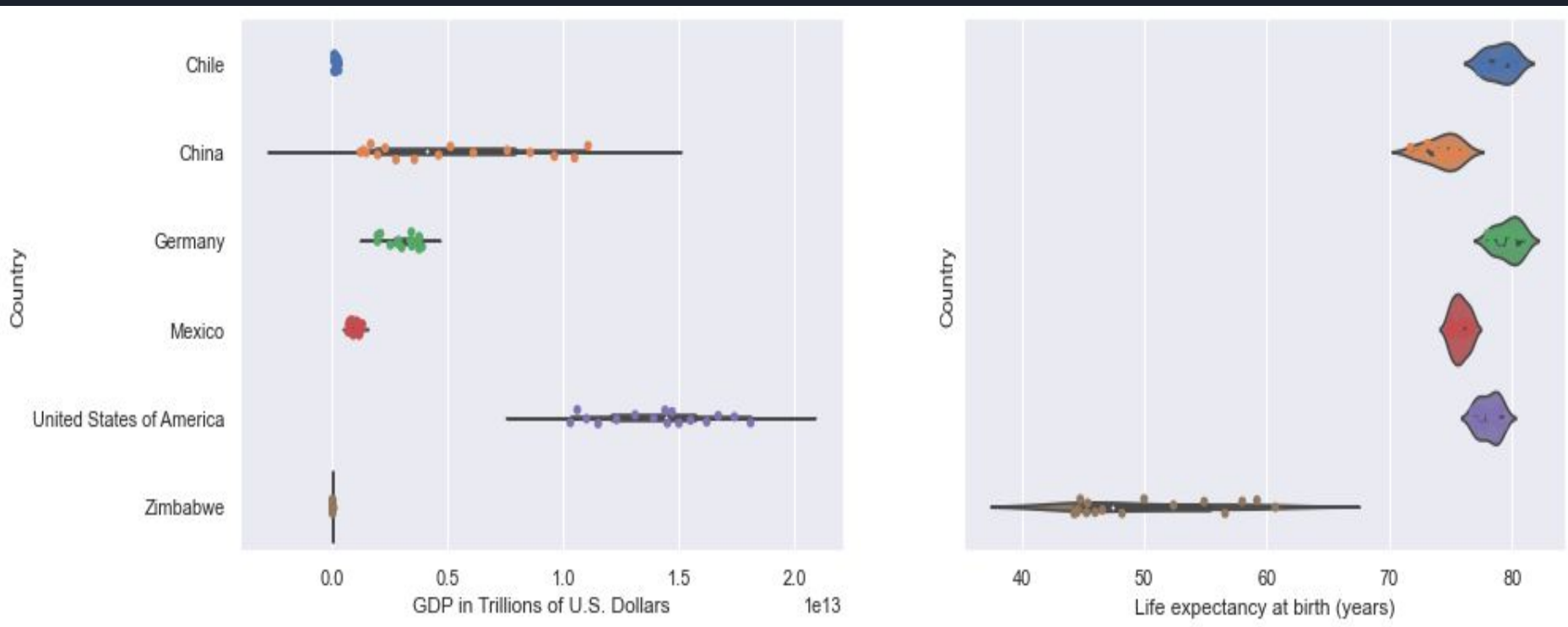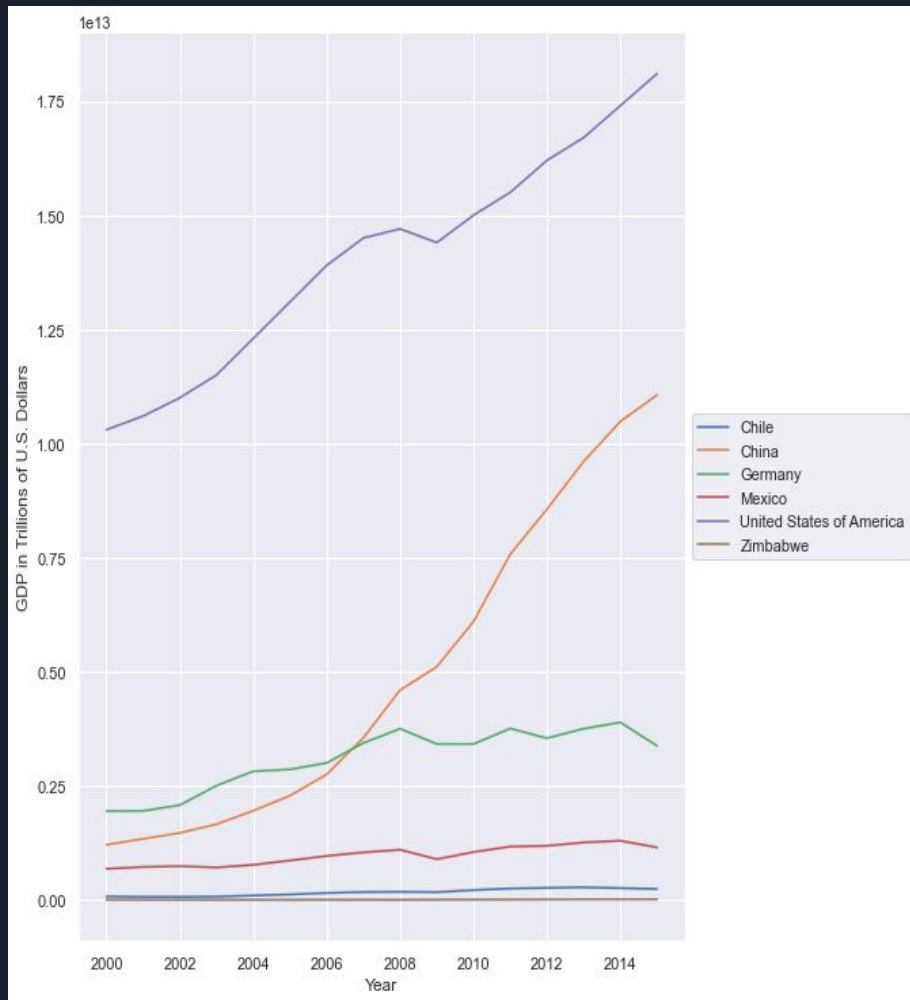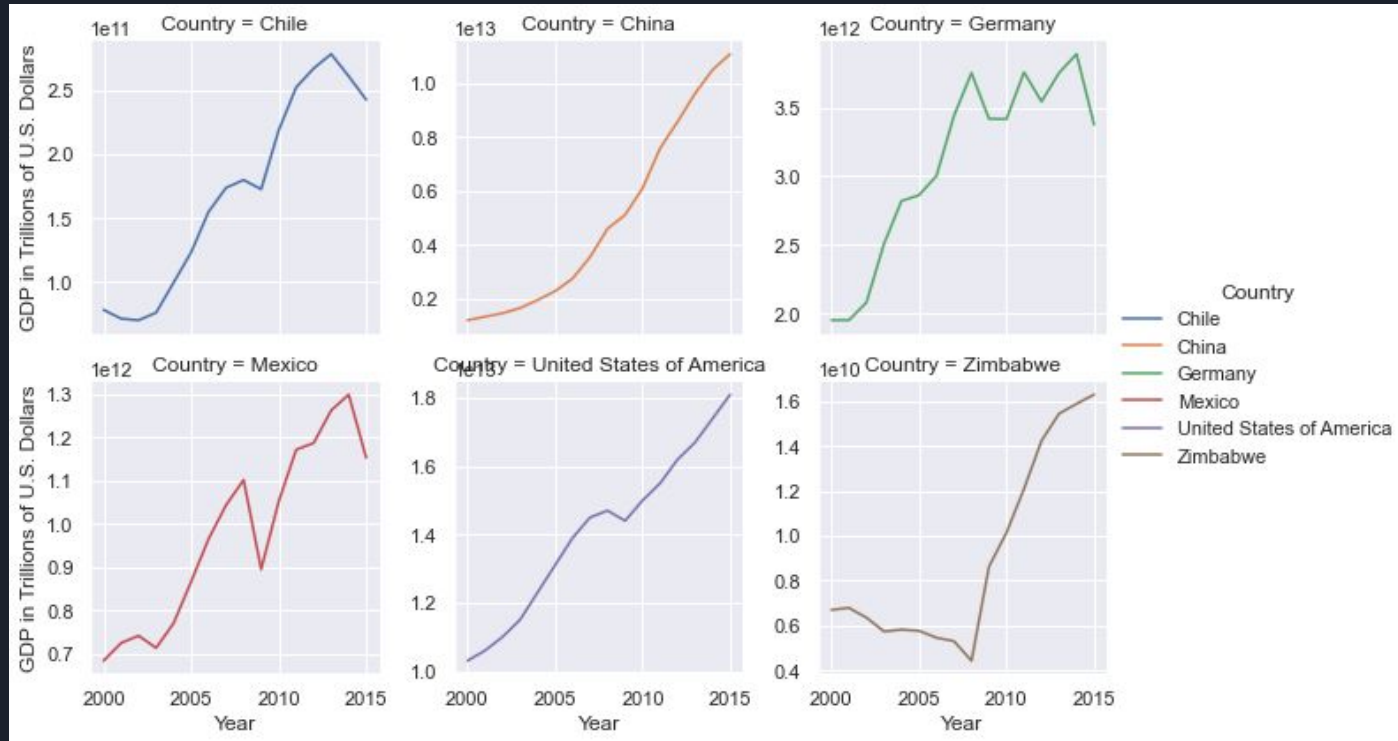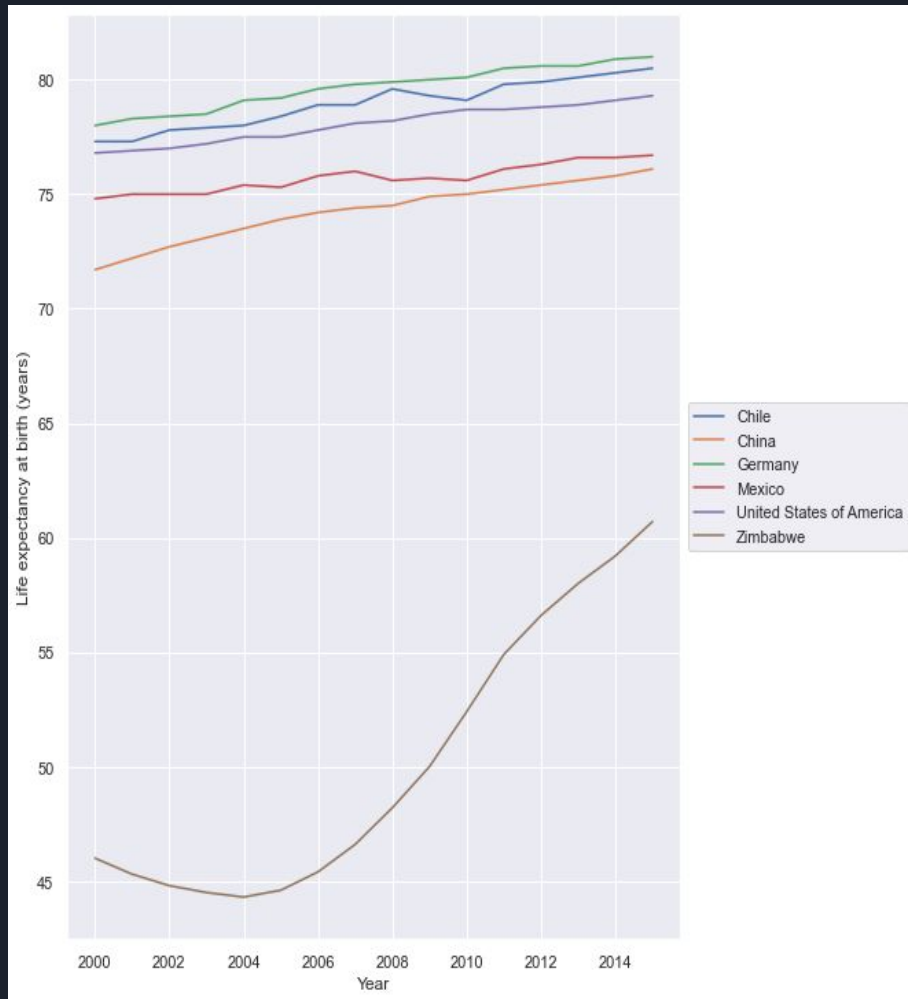
## Line Charts of GDP

Next the data will explore GDP and LEABY over the years through line charts. Below the countries are separated by colors and one can see that the US and China have seen substantial gains between 2000-2015. China went from less than a quarter trillion dollars to one trillion dollars in the time span. The rest of the countries did not see increases in this magnitude

Another aspect that was looked more into depth was the faceted line charts by Country. In the individual plots, each country has their own y axis, which makes it easier to compare the shape of their GDP over the years without the same scale. This method makes it easier to see that all of the countries have seen increases. In the chart above, the other country's GDP growth looked modest compared to China and the US, but all of the countries did experience growth from the year 2000.

## Line Charts of LEABY

Much like the break down of GDP by country before, the plot below breaks out life expectancy by country. It is apparent that Chile, and Mexico seemed to have dips in their life expectancy around the same time which could be looked into further. This type of plotting proves useful since much of these nuances were lost when the y axis was shared among the countries. Also the seemingly linear changes were in reality was not as smooth for some of the countries.

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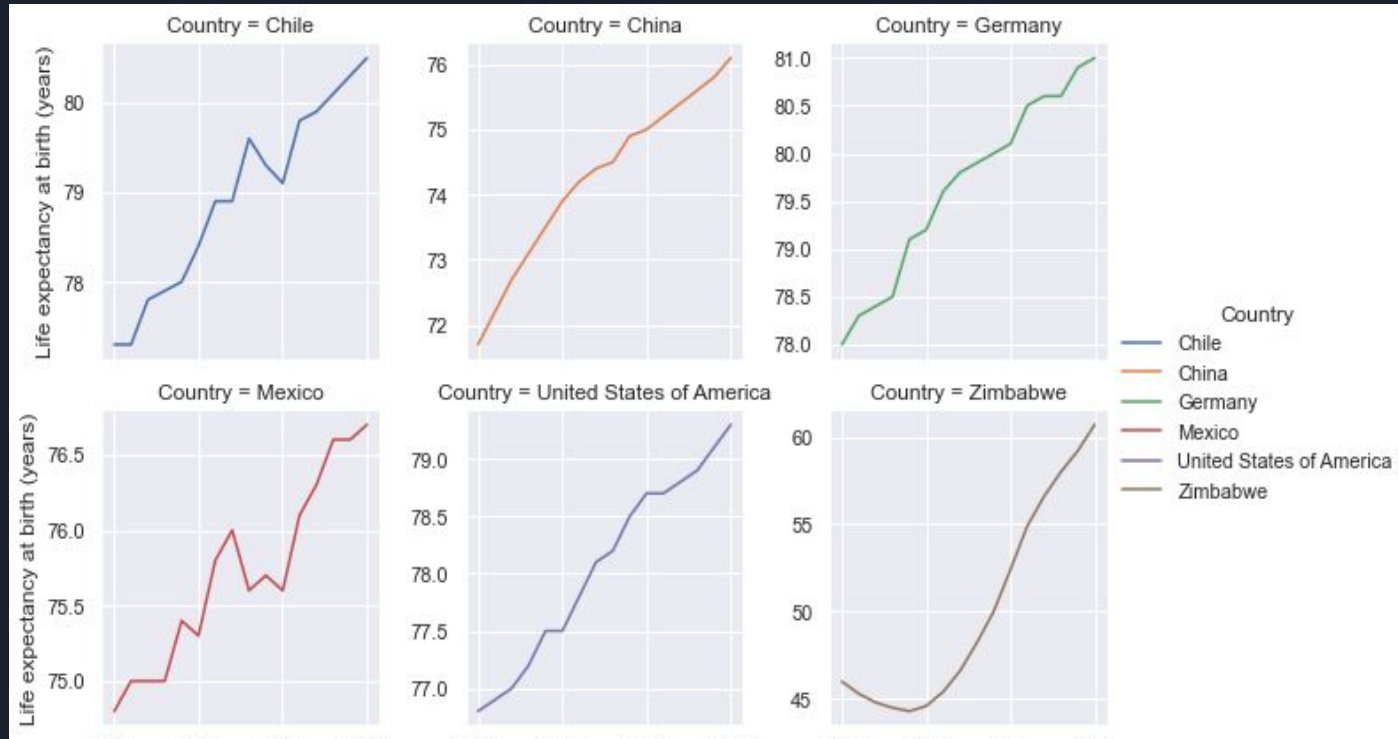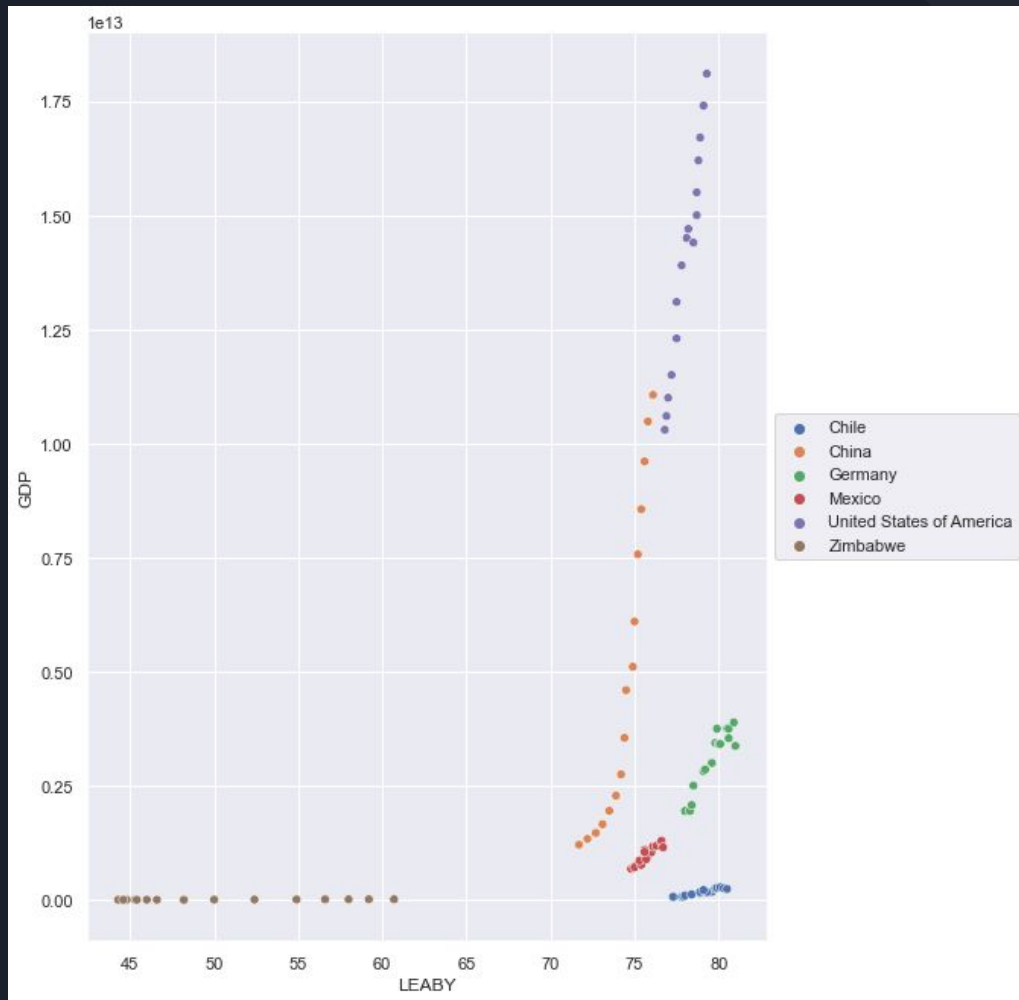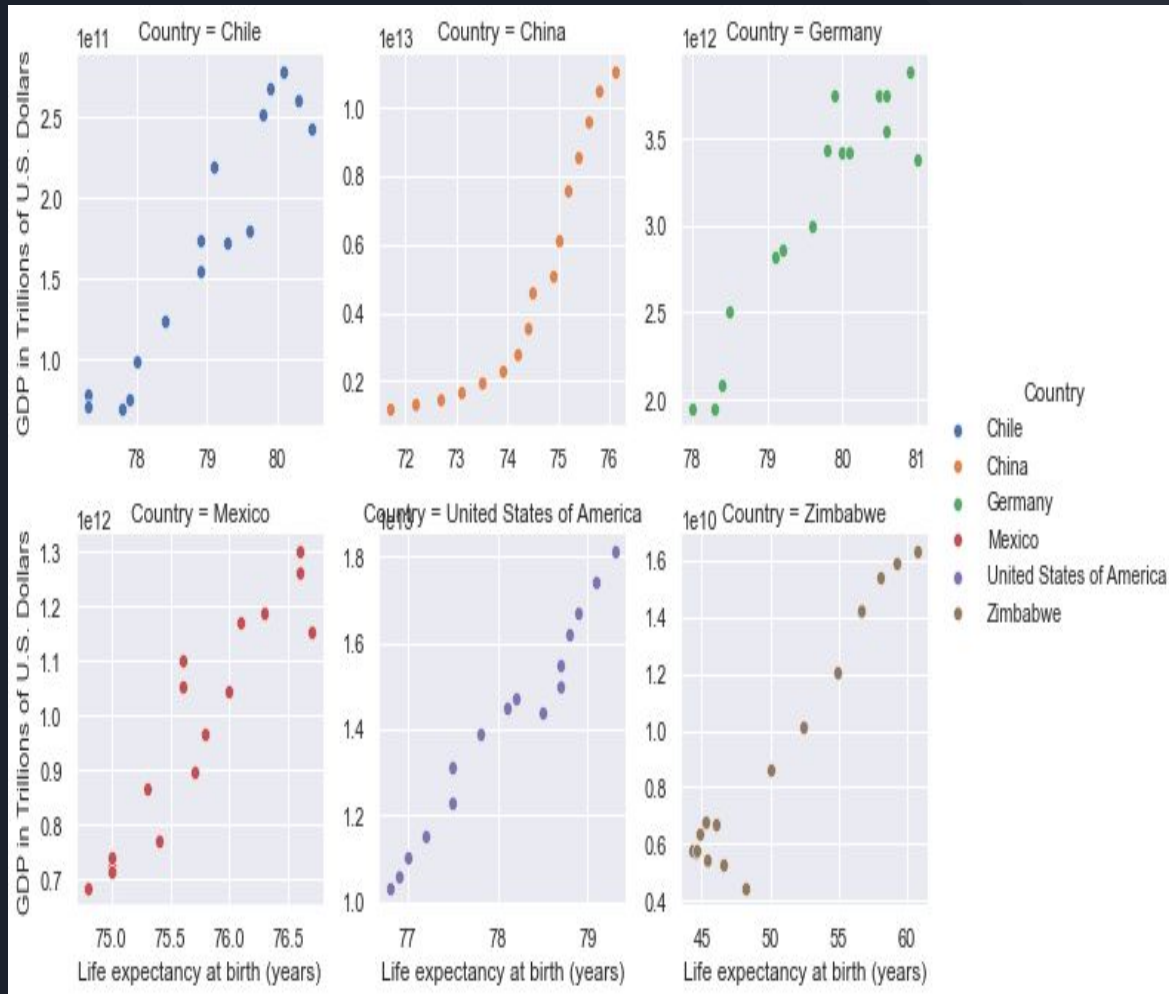
## Scatter Plot of GDP and LEABY

The next two charts will explore the relationship between GDP and LEABY. In the chart on left, it looks like the previous charts where GDP for Zimbabwe is staying flat, while their life expectancy is going up. For the other countries they seem to exhibit a rise in life expectancy as GDP goes up. The US and China seem to have very similar slopes in their relationship between GDP and life expectancy.

## Scatter Plot by Countries

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# Are the Results What We Expected?

Overall, the results align with our expectations based on existing knowledge and prior research. The positive correlation between GDP and life expectancy is well-established, and it is encouraging to see that all countries in our study experienced economic growth and improvements in life expectancy.However, the lower average life expectancy in Zimbabwe highlights the importance of considering unique historical and cultural factors that can impact outcomes within a specific country.

## Key Findings:

1. GDP and Life Expectancy: Life expectancy has generally increased over time in all six nations, with Zimbabwe showing the greatest improvement. GDP has also risen in all countries, with notable growth in China.
2. Correlation: There is a positive correlation between GDP and life expectancy, indicating that as GDP increases, life expectancy tends to rise as well.
3. Average Life Expectancy: Most countries had an average life expectancy in the mid to high 70s, except for Zimbabwe, which was lower at around 50.
4. Cultural Factors: Histories and cultural values play a role in shaping GDP and life expectancy. Work ethic, education, healthcare priorities, and health attitudes contribute to disparities among nations.

## Takeaways:

1. Economic development positively impacts health outcomes, as higher GDP is associated with increased life expectancy.
2. Historical and cultural factors influence a country's economic and health outcomes, highlighting the need for context-specific approaches.
3. Data reliability can be enhanced through larger sample sizes, longer timeframes, and improved accuracy in data collection.
4. Understanding these relationships helps policymakers make targeted interventions to improve economic and health outcomes.

## Conclusion:

Our exploration of the relationships between GDP, life expectancy, and cultural factors reveals a positive correlation between economic development and health outcomes. By addressing cultural factors and making informed investments, policymakers can foster sustainable growth and improve the well-being of their populations. Understanding the complexities and interplay between economic, social, and cultural factors is crucial for designing effective policies that promote both economic prosperity and better health outcomes. By focusing on holistic development and considering the unique context of each country, policymakers can work towards a future where economic growth and improved life expectancy go hand in hand.