How Life Expectancy and GDP Are Related Across Countries

A data analysis of the gap minder dataset using Python and Seaborn

# Introduction

Life expectancy (LE) and gross domestic product (GDP) are two important indicators of human development and well-being. LE measures the average number of years that a person can expect to live, while GDP measures the total value of goods and services produced by a country in a year. Both LE and GDP reflect the health, education, income, and quality of life of a population. But how are they related? Do countries with higher GDP have higher LE? Does GDP and LE change over time? And does the country itself affect these variables?

In this post, I will explore these questions using the World Health Organization and the World Bank dataset, which contains data on LE, GDP, and population for 6 countries from 2000 to 2015. I will use Python and Seaborn to perform some exploratory data analysis and visualization and share some insights and findings from the data.

# Data Overview

The dataset has four columns: country, year, lifeExp, and gdpPercap. Country and year are categorical variables, while lifeExp and gdpPercap are numerical variables. LifeExp is the life expectancy at birth in years, and GDPPercap is the GDP per capita in US dollars (adjusted for inflation and purchasing power parity). The dataset has 96 rows, corresponding to 16 observations for each of the 6 countries over 2 decades (2000, 2001, ..., 2015).

To get a sense of the distribution and range of the data, I used the describe() method to generate some summary statistics for the numerical variables. Here are the results:

|  |  |  |
| --- | --- | --- |
| **Country** | **Age mean (year)** | **GDP mean (billion dollars)** |
| Chile | 78.94375 | 169.788845 |
| China | 74.2625 | 4957.71375 |
| Germany | 79.65625 | 3094.775625 |
| Mexico | 75.71875 | 976.650625 |
| United States of America | 78.0625 | 14075 |
| Zimbabwe | 50.09375 | 9.062579595 |

* **Average Age Mean**: The **average age mean** of the countries listed is approximately **72.79 years**.
* **Average GDP Mean**: The **average GDP mean** is about **$3880.50 billion**.
* **Germany** has the **highest average age** at **79.66 years**, indicating a relatively older population.
* **Zimbabwe** has the **lowest average age** at **50.09 years**, suggesting a younger population demographic.
* **The United States of America** has the highest GDP mean at **$14075 billion**, reflecting its large economy.
* **Zimbabwe** again appears at the other end of the spectrum with the **lowest GDP mean** at approximately **$9.06 billion**.

# Data Visualization

To answer the questions posed by the user, I created some plots using Seaborn, a Python library for data visualization. Seaborn has many built-in functions and features that make it easy to create beautiful and informative plots with minimal code. I used the following plots to explore the data:

* A Bar chart to show the average LE and GDP for each country.
* A scatter plot to show the relationship between LE and GDP per capita for each country and year.
* A line plot to show the trend of LE and GDP per capita over time for each country.
* A box plot to show the distribution of LE and GDP per capita by country.

Here are the plots and some observations from them:

A graph with blue squares

Description automatically generated

This graph compares the Gross Domestic Product (GDP) of six different countries: Chile, China, Germany, Mexico, the United States of America, and Zimbabwe. Here are the key takeaways:

**Germany**: With an average GDP of approximately 3.8 trillion dollars, Germany stands out among the countries analyzed. Despite its smaller population, Germany’s robust economy contributes significantly to its GDP.

**United** **States**: The United States boasts the highest GDP, surpassing 14 trillion dollars. Its economic strength is evident, reflecting its large population, diverse industries, and global influence.

**China**: China follows closely, with an average GDP of around 11 trillion dollars. As the world’s most populous country, China’s rapid economic growth has propelled it to the forefront of global economics.

**Zimbabwe**: In stark contrast, Zimbabwe’s GDP is significantly lower, hovering around 9 billion dollars. Economic challenges and a smaller population contribute to this disparity.

A graph with blue and white bars

Description automatically generated

This graph compares the average life expectancies in six different countries: Chile, China, Germany, Mexico, the United States of America, and Zimbabwe. Here are the key takeaways:

**Germany**: With an average life expectancy of approximately 79.66 years, Germany stands out among the countries analyzed. Its well-developed healthcare system and high standard of living contribute to this longevity.

**United States and Chile**: The United States has an average life expectancy of approximately 78.06 years, which aligns with other developed countries like Germany.

**China and Mexico**: These countries fall within a similar range, with average life expectancies ranging from approximately 74 to 76 years. Their healthcare systems and overall well-being contribute to these figures.

**Zimbabwe**: In stark contrast, Zimbabwe has the lowest average life expectancy of all listed countries, at around 50.09 years. Challenges related to healthcare access, economic instability, and other social factors impact life expectancy.

A graph of different colored lines

Description automatically generated

**China:** China exhibits consistent and robust GDP growth throughout the years. Starting just above 12.1 in 2000, it ended close to 13.0 in 2014.

**United States of America (USA)**: The USA also experiences growth, but at a slower pace compared to China. Its GDP starts around 13.0 and reaches approximately 13.2 by 2014.

**Germany and Chile:** Both countries show steady GDP growth, although at lower levels than China and the USA. Germany starts at around 12.4 and Chile around 10.9, gradually increasing over the years.

**Mexico:** Mexico’s GDP remains relatively flat with minor fluctuations, hovering around 11.9.

**Zimbabwe:** Unfortunately, Zimbabwe faced a decline in GDP until around 2008, after which it started recovering but remains significantly lower than other countries.

A graph with different colored lines

Description automatically generated

**Chile, China, Germany, Mexico, and the United States:**

* These countries exhibit relatively stable and high life expectancies, ranging from around 70 to 81 years.
* Their life expectancy trends remain consistent over the period from 2000 to 2014.

**Zimbabwe:**

* Zimbabwe stands out with a significantly lower life expectancy.
* However, there is a remarkable improvement in Zimbabwe’s life expectancy during this time frame.
* The trend sharply increases, indicating positive developments in healthcare and quality of life.

A graph of different colored dots

Description automatically generated

The scatter plot in the image illustrates the relationship between LE and GDP for six different countries. As GDP (a measure of a country’s wealth) increases, the LE of the population tends to increase as well, indicating a positive correlation between economic prosperity and the LE of a country’s inhabitants.

A screenshot of a graph

Description automatically generated

This visualization compares GDP and life expectancy trends across six countries (Chile, China, Germany, Mexico, United States of America, and Zimbabwe) from 2000 to 2014. Here are the key takeaways:

* Positive Correlation: Generally, there is a positive correlation between GDP and life expectancy. As GDP increases, life expectancy tends to rise as well.
* Diverse Trajectories:
  + Chile: Steady increase in both GDP and life expectancy.
  + China: Rapid growth in GDP and life expectancy.
  + Germany: Gradual increase in both indicators.
  + Mexico: Moderate growth in GDP and life expectancy.
  + USA: Slight fluctuations but an overall upward trend.
  + Zimbabwe: Significant decline in GDP, followed by a recovery, while life expectancy shows fluctuations.
* Outliers: Zimbabwe stands out due to its sharp decline in life expectancy during the early 2000s, likely influenced by socio-economic factors.
* Policy Implications: These trends highlight the importance of economic development and healthcare policies in shaping population health.

# Conclusion

The plots show that LE and GDP per capita are connected, as GDP goes up and down, LE follows. This suggests that there is a positive correlation between these two variables, meaning that countries with higher GDP tend to have higher LE, and vice versa. However, the correlation is not perfect, as there are some outliers and variations among countries and regions. For example, some countries have relatively high LE despite having low GDP, such as Chile, while some countries have relatively low LE despite having high GDP, such as China.

Interestingly, Zimbabwe, which is almost non-existent on the other plots, shows a huge increase in LE along with an increase in GDP in the last decade. LE in Zimbabwe rose from a low of 45 years in 2002 to 60+ years in 2007, and GDP per capita rose from around 0.4 billion US dollars to 1.6 billion US dollars in the same period. This is a remarkable improvement, considering that Zimbabwe suffered from political and economic crises, hyperinflation, and the HIV/AIDS epidemic in the previous years. Though Zimbabwe is still behind the rest of the countries in the data in terms of absolute values, it is showing a promising trend of recovery and growth.

The key findings from this data analysis are: To expand life expectancy, the countries should increase their GDP. However, GDP is not the only factor that affects LE, as other social, environmental, and cultural factors also play a role. Moreover, the country itself matters, as different countries have different histories, policies, and challenges that shape their development and well-being. Therefore, it is important to look at the data from multiple perspectives and dimensions, and not to draw hasty conclusions based on simple statistics or averages.