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Blog

Established proof of the non-obvious relationship between GDP and Life Expectancy

Reading Time: 9 minutes

Terms in use

- As defined here, Life Expectancy is a figure representing the number of years, based on known statistics, to which any person of a given age may reasonably expect to live.
- As defined here, Gross Domestic Product (GDP) is the overall monetary or consumer value of all finished goods and services produced within the boundaries of a nation over a given period. It acts as a large measure of overall domestic output, as a detailed scorecard of the economic health of the country. GDP is measured in US dollars.

Introduction

In this project, we will analyze data on Life Expectancy at Birth (years) (LEABY) and Gross Domestic Product (GDP) from the World Health Organization and the World Bank to try to identify the relationship between the GDP and LEABY of six countries (Chile, China, Germany, Mexico, United States of America, Zimbabwe) over fifteen years.

During this project, we will analyze, prepare, and plot data in order to answer in a meaningful way some questions such as:

- 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?

Telling stories with data and driving that culture to help companies to make data-driven decisions based on perspective and predictive analysis is my passion.

Category: Data Science, Data Analytics

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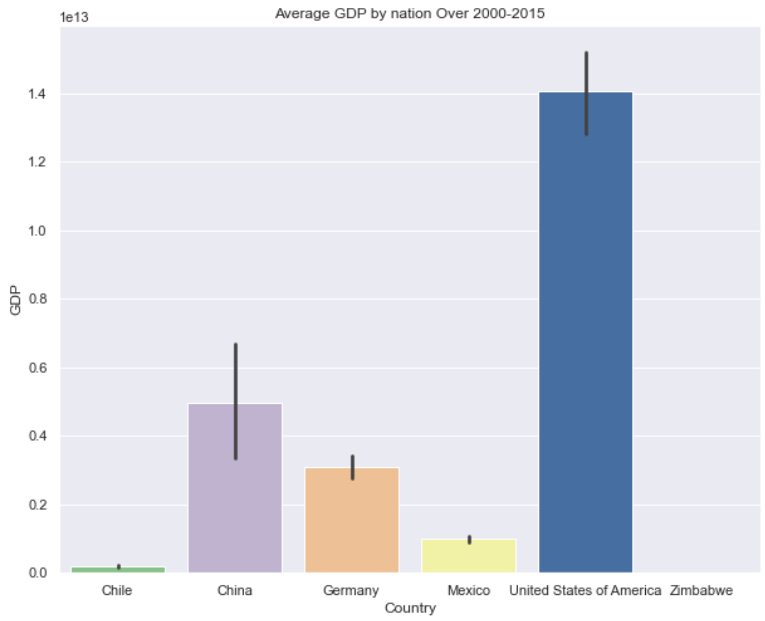
Data sources

- Life expectancy Data Source: World Health Organization
- GDP Source: World Bank national accounts data, and OECD National Accounts data files.

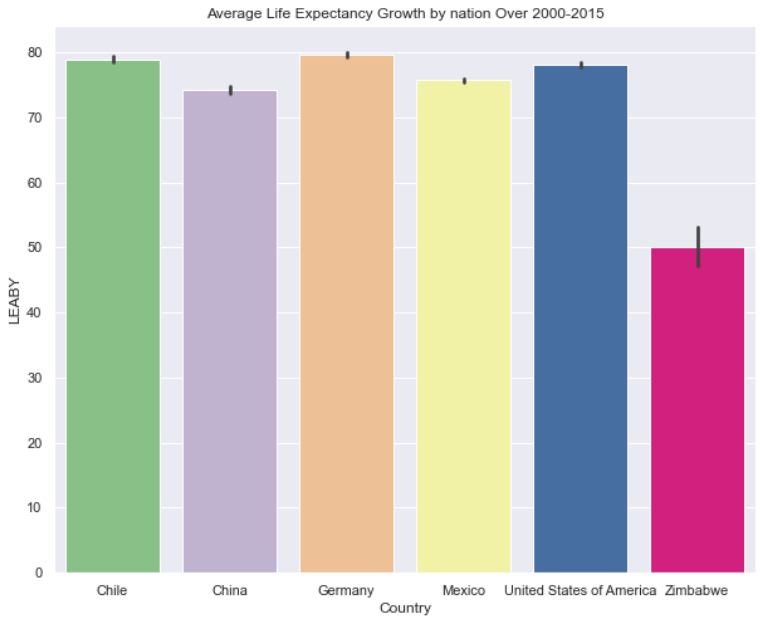
Comparing the Average using bar charts

First, we are going to create a bar chart in order to take the first high level of the World Bank data.



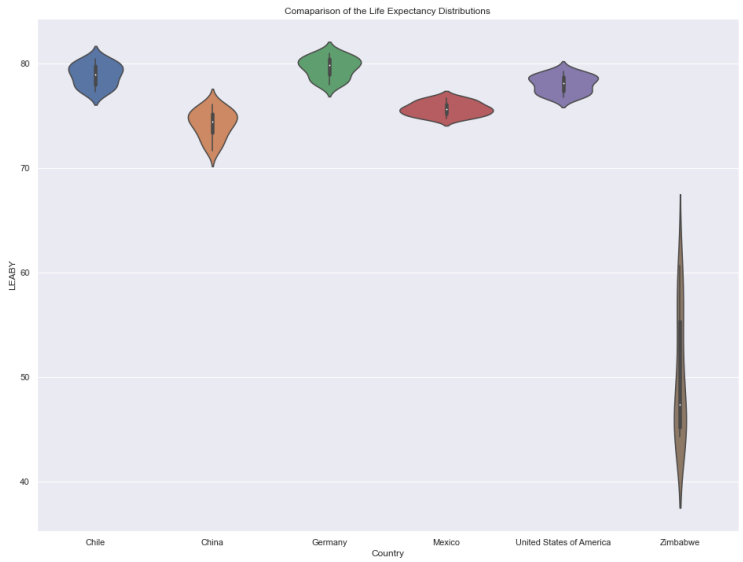
Here, this chart shows clearly the predominance of the US wealth followed successively by China, Germany, Mexico, Chile, and Zimbabwe over 2000-2015.

Now, let's create a bar chart of the World Health Organization data.



We can see that all of the countries except Zimbabwe have the average life expectancy growth higher than 50s.
To get more insight, we'll use another way to visualize the distribution of our data.

Comparing Life expectancy Distributions using Violin Plots.

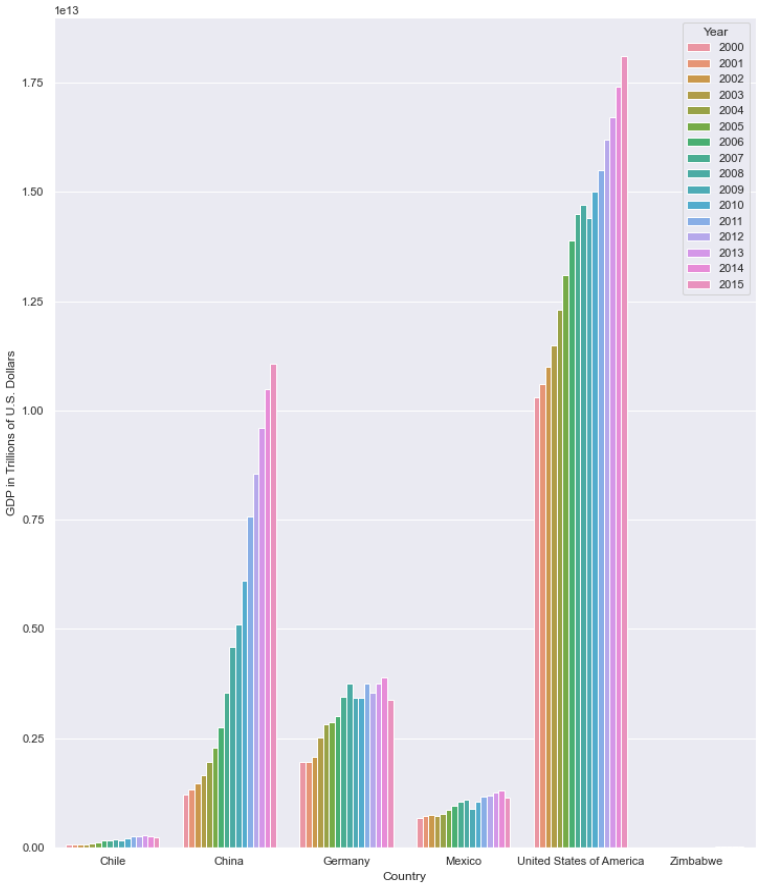


Here, this chart shows that all of the countries except Zimbabwe have the average life expectancy growth in the mid-to-high 70s but, the latter recorded the most life expectancy change.

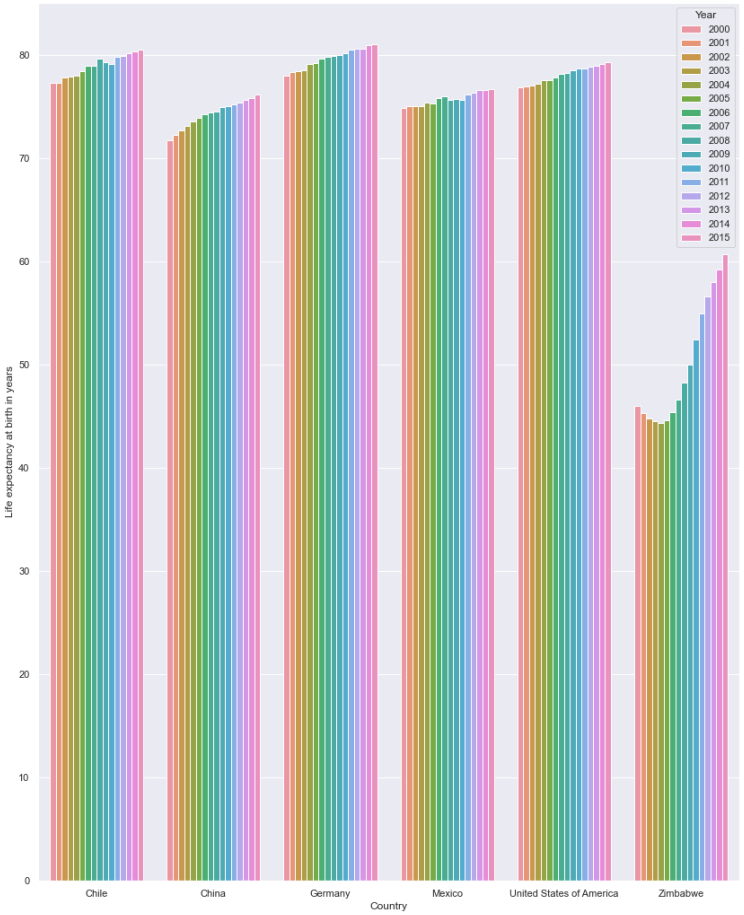
Bar Plots of GDP and Life Expectancy over time

Here, we want to compare the GDPs of the countries over time, in order to get a sense of the relationship between GDP and life expectancy.

First, let's plot the progression of GDP over the years by country in a barplot using Seaborn.



Second, let's plot a barplot that clusters life expectancy over time by country.

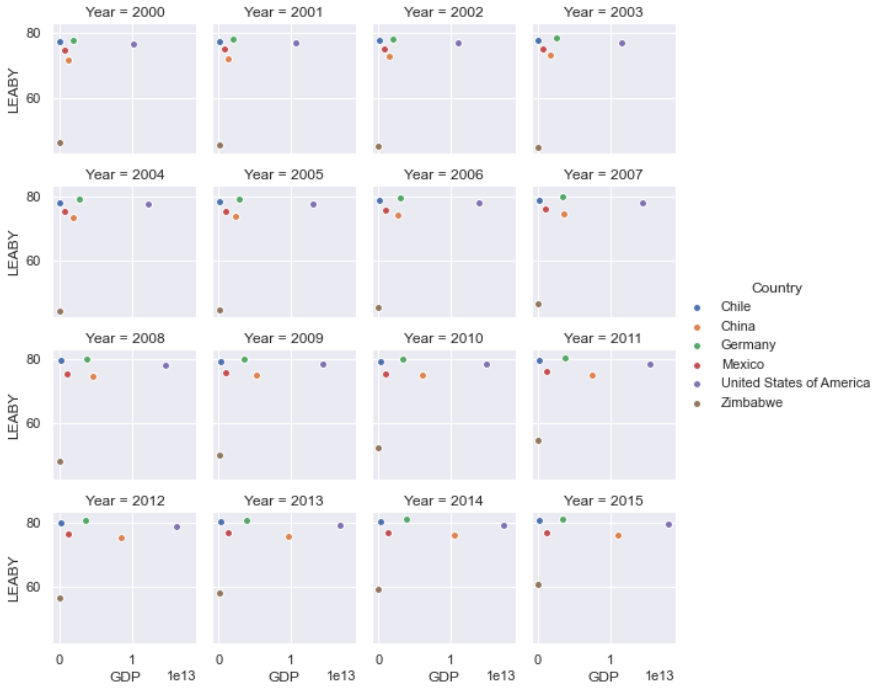


- Zimbabwe, Chile, and Mexico are the counties with most changes in their life expectancy while the USA, China, Germany, and recorded the most change in GDP.

- The biggest changes were recorded over 2013-2015.
- Zimbabwe is the country that has had the least change in GDP over time.
- Regarding the GDP, it looks like the GDP of China increased steadily than the GDP of the USA, Germany and Mexico.
- Regarding the LEABY, it looks like Germany seems to be in the lead followed respectively by Chile, the USA, Mexico and China.
- It looks like there is no dependency relationship between LEABY and GDP. We have seen that all high GDP countries have high LEABY, but many high LEABY countries also have low GDP. For example, Chile and Mexico have a low GDP but they have a high LEABY (years) almost equal to that of the United States. Even if their GDP did not grow at the same rate as the United States and China, they still have a high LEABY (years). Similarly, Germany, which had the highest LEABY over fifteen years, had a fluctuating GDP that was lower than the GDP of the United States. Therefore, it seems that the relationship between GDP and life expectancy at birth (years) was not so obvious.
- At first glance, one might think that economic development factors explain the data collected but, nothing is certain.

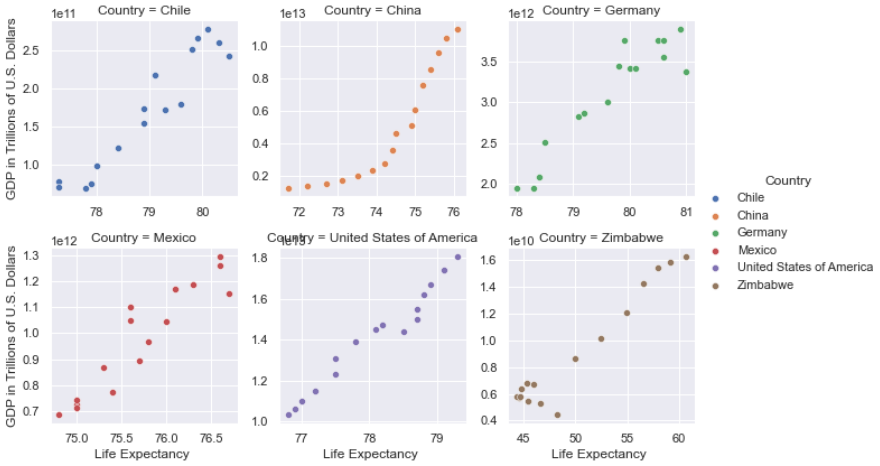
Now that we've mapped two bar plots exhibiting a variable over time by country, however, bar charts are not traditionally used for this purpose. In fact, a great way to visualize a variable over time is by using a line plot. While the bar charts tell us some information, we think that the data would be better illustrated on a line plot.

Visualizing GDP and Life Expectancy Data using scatter plots



- No noticeable change in the movement of data points for Chile, Mexico, China, and Germany could be discerned between 2000 and 2004, but the GDP of China and Germany started to move off along the x-axis which means that their GDP went up.
- From 2004 t0 2015, China and the United States are the countries with GDP that have mostly moved onward along the x-axis: their GDP has considerably increased over that period.
- Whereas, the GDP of Zimbabwe had mostly moved upward along the y-axis which means that life expectancy at birth (year) in this country had increased sharply over time. Moreover, Life expectancy at birth (year) in Chile and Mexico remained constant for fifteen years. Lastly, for Germany, both GDP and Life expectancy at birth (year) move slightly over the fifteen years.
- Based on the analysis we've done so far, it's not surprising..

These scatter plots are not easy to read because we can not distinguish movements along the axis and describe them with accuracy. Maybe other plots can help. Nevertheless, we can better visualize the correlation between GDP and life expectancy using the scatter plots.



Now, our chart shows a positive correlation between LEABY and GDP for all the countries.

Line Plots for Life Expectancy

This chart shows the growth of the Life expectancy in Chile, China, Germany, Mexico, United States of America, and in Zimbabwe from 2000 to 2015.

From 2000 to 2004 Life expectancy of Zimbabwe decreased little by little from 46.0s to 44.3s before it began to increase steeply until 2015 where it reached 60.7s.

In 2000 tLife expectancy of Chile was 77.3s and this number remained constant until 2001. From that time on, its Life expectancy went up gradually and it reached 79.6s in 2008. Between 2008 and 2010 there was a slight drop to 79.1s before the increase happened quickly, and it reached 79.8s in 2011. From that time, it continued to grow until 2015.

There was a little increase in the Life expectancy of Mexico from 74.8s in 2000 to 75.0s in 2001. Then, it remained steady at 75.0s between 2001 and 2003. Between 2003 and 2007 it peaked at 76.1s. In 2008 Life expectancy fell rapidly to 75.6. It fluctuated between 2008 and 2011 before it started to increase gradually until 2015.

While the Life expectancy of China increased sharply from 71.7s in 2000 to 76.1s in 2015, the Life expectancy of Germany and USA increased significantly respectively from 78.0 in 2000 to 81.0s in 2015 and from 76.8 in 2000 to 79.3s in 2015.

Overall, there was an increase of the Life expectancy for all the nations. Germany had the highest Life expectancy. The USA had the second largest followed by Chile, Mexico, China, and Zimbabwe over 2000 - 2015.

Line Plots for GDP

This chart shows the graph of GDP of the six nations over 2000 – 2015.

The GDP of Chile reached its lowest point between 2000 and 2003 and it went up significantly between 2003 and 2007. Between 2007 and 2009 there was a little drop before it started to increase sharply and peaked at almost 2.7 T in 2013 but it plunged considerably around 2.4 T in 2015.

The GDP of Mexico fluctuated from 0.7 T in 2000 to 0.8 T in 2004 and it increased sharply to reach 1.1 T between 2007 and 2008, but it plunged dramatically to 0.9 T between 2008 and 2009. From that time, it went up sharply and reached a peak at1.3 T between 2013 and 2014 but it fell dramatically below 1.2 T in 2015.

With its lowest at 0.2 T in 2000, the GDP of China increased sharply and peaked around 1.2 T in 2015. The GDP of the United States of America climbed sharply from 1.0 T in 2000 to around 1.5 T in 2008, but it dropped slightly between 2008 and 2009. Next, it boomed to reach a peak at 1.8 T in 2015.

The GDP of Germany increased vastly from 2.0 T in 2000 to around 3.7 in 2008. From that time, it fluctuated before it peaked at 3.9 T in 2014, but it fell steeply to 3.4 in 2015.

The GDP of Zimbabwe decreased steadily from 0.7 T in 2000 to its lowest 0.4 T in 2008, but it rose sharply and peaked at 1.6 T in 2015.

Overall, there was an increase in GDP of all the nations from 2000 to 2015 except Zimbabwe for which the boom happened only from 2008 to 2015.

Conclusion

With the development of this project, we learned some aspects of the relationship of life expectancy and GDP from data visualizations. Even though the data we utilized was not quite big, it helped us to get insight into the non-obvious relationship between life expectancy and GDP of the six nations from 2000 to 2015. Also, the development of this project gave responses to some questions asked at the top beginning.

- Does higher GDP mean higher LEABY?
    - No, we saw that all the countries with high GDP have high LEABY but many countries with high LEABY also had low GDP. For example, Chile and Mexico have low GDP but they have high LEABY (years) almost equal to the one USA had. Even though their GDP was not increasing at the same rate as the USA and China, they still have high LEABY (years). Likewise, Germany that had the highest LEABY over the fifteen years had a fluctuated GDP lower than the GDP of the USA. Therefore, it seems that the relationship between GDP and Life expectancy at birth (years) was not so evident.
- How does the LEABY vary on average by country over fifteen years?
    - In general, there was an increase of the Life expectancy at birth (year) for all the nations. Germany had the highest LEABY. Chile had the second largest LEABY followed by the USA, Mexico, China, and Zimbabwe in 2015. In fact, the average life expectancy was between mid to high 70s for the countries except for Zimbabwe which was 50 even though this nation had the highest rise in LEABY.

- How does the GDP vary on average by country over fifteen years?
    - Overall, the United States of America had the largest average GDP. China had the second largest followed by Germany, Mexico, and Chile. Whereas, in terms of growth, there was an increase in GDP for all the nations particularly for China.
- Is there a correlation between GDP and life expectancy of a country?
    - Yes, there is a positive correlation between GDP and life expectancy for all the nations in our study.

All in all, this project demonstrates that LEABY and GDP were in growth and the correlation between them was positive for each country in our list from 2000 t0 2015. That was a great benefit for the nations. Unfortunately, rising GDP hasn't always been linked with prosperous life expectancy as shown in this World Economic Forum article.