



# LIFE EXPECTANCY & GDP

FROM SIX COUNTRIES AROUND THE WORLD

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## INTRODUCTION

This project involves the analysis of data from six different countries around the world on their life expectancy and GDP. This data covers every year from 2000 to 2015.

A few questions this project looks at:

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

### Data Source

The data used is provided by Codecademy.com.

### Data Set Used

***all\_data.csv*** with four columns of data:

- *Country*: the name of the country the data is from
- *Year*: the year the data was collected
- *Life expectancy at birth (in years)*: the average life expectancy at birth in years
- *GDP*: the gross domestic product in trillions of US dollars

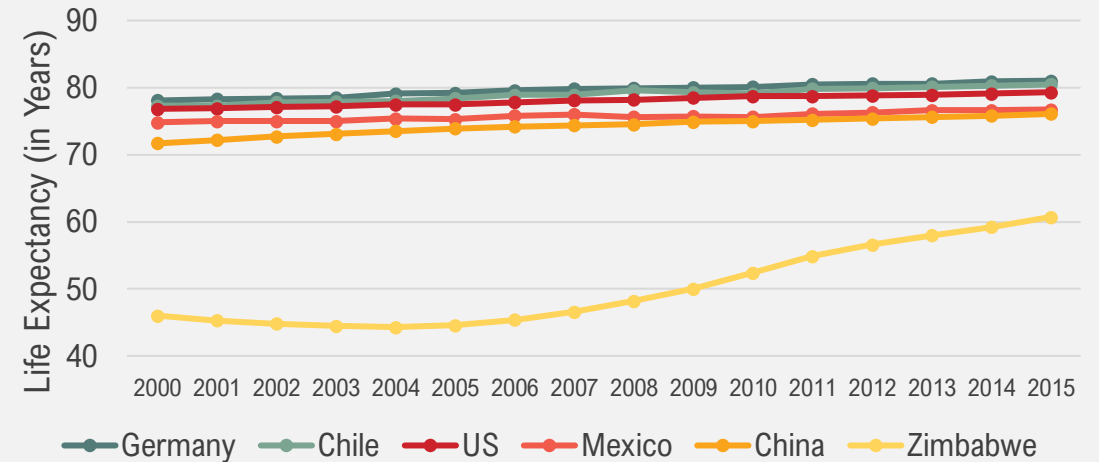
# LIFE EXPECTANCY

The six countries included in the data are:  
Germany | Chile | United States | Mexico | China | Zimbabwe

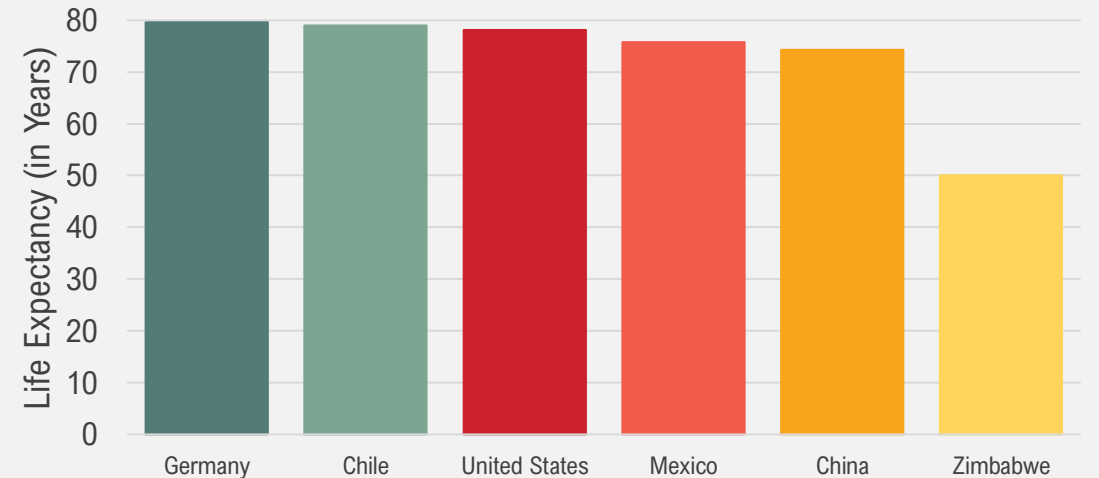
Looking at all six country's life expectancies together, we can see that Germany has the highest life expectancy every year from 2000 to 2015. We can also see that Zimbabwe has the lowest life expectancy each year from 2000 to 2015, giving it the lowest average life expectancy for the 16 years as well.



## Life Expectancy by Country (2000-2015)



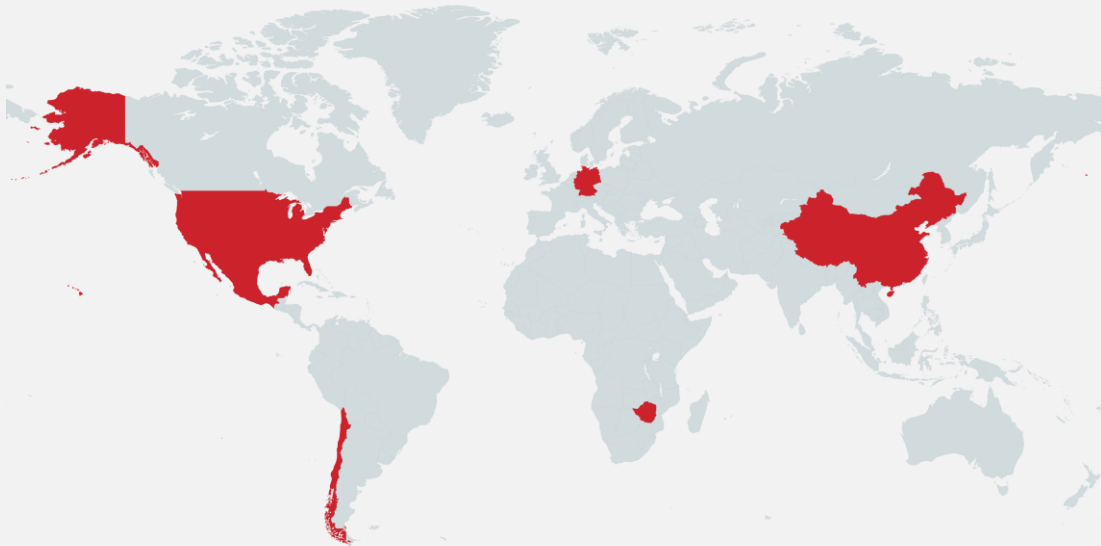
## Average Life Expectancy by Country (2000-2015)



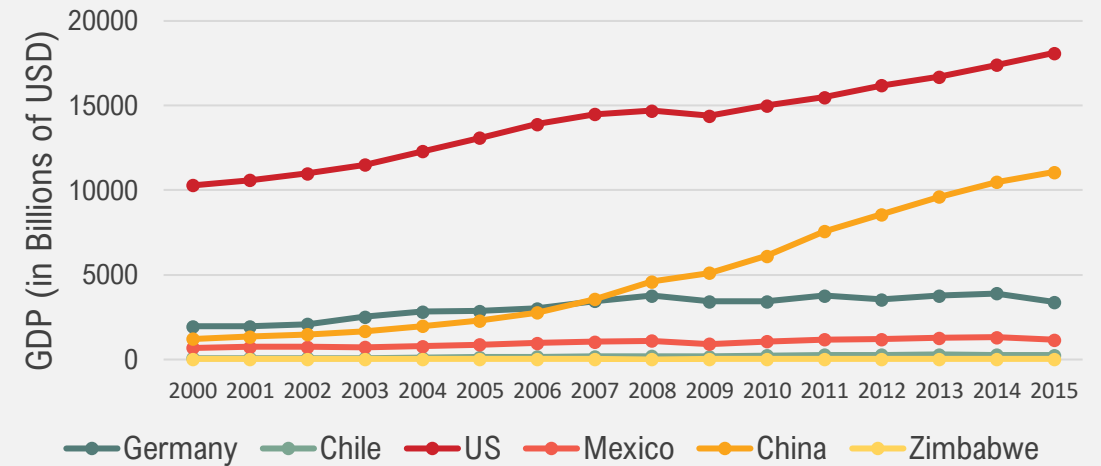
# GDP

Looking at the GDP for all six countries also gives us some insights. The United States has the highest GDP of all six countries every year from 2000 to 2015. Similarly to its life expectancy, Zimbabwe's GDP is the lowest of all countries for every year from 2000 to 2015.

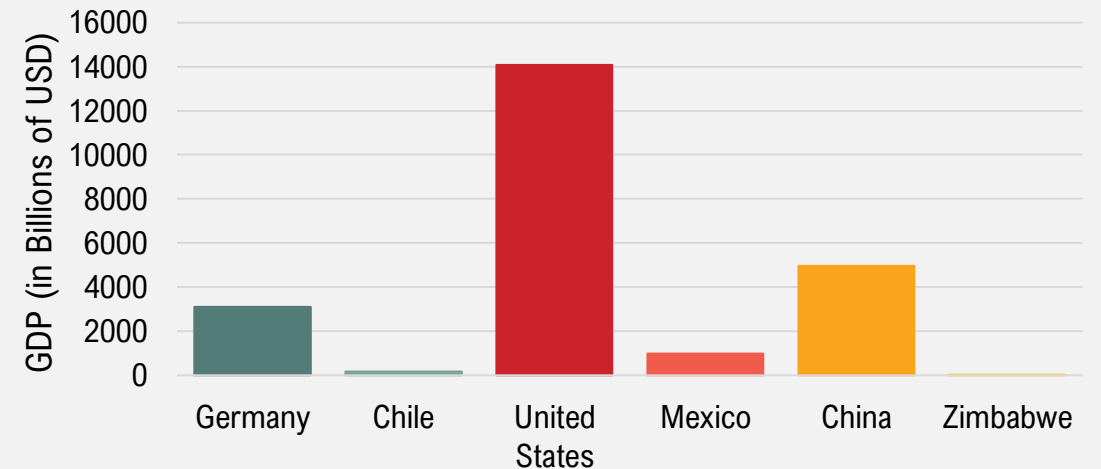
China's GDP seems to have the most drastic increase of all six countries over the 16-year time period.



## GDP by Country (2000-2015)



## Average GDP by Country (2000-2015)



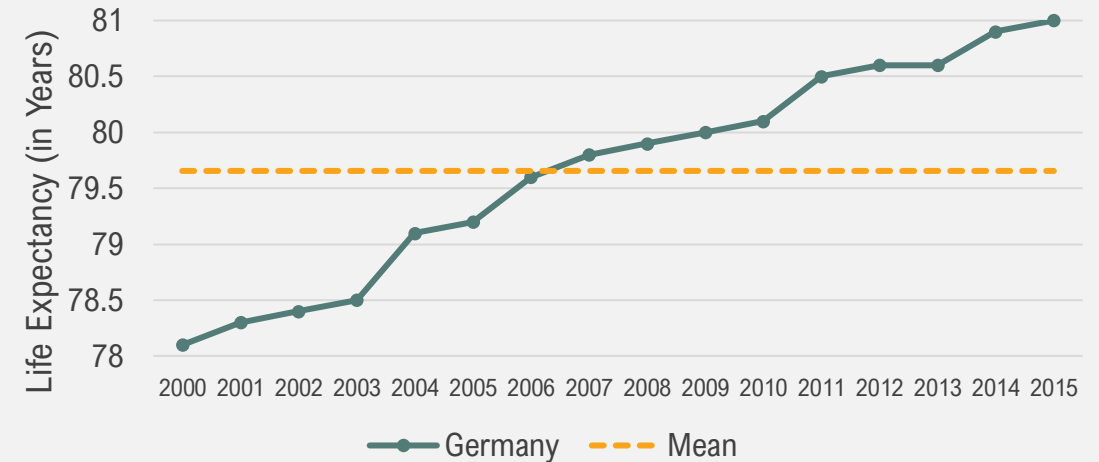
# COUNTRY ONE: GERMANY

Germany's life expectancy seems to steadily rise throughout the entire 16-year time period. It remains fairly consistent, with only a 3.8% increase from 2000 to 2015. The largest increase in life expectancy occurs between 2003 and 2004, when life expectancy increased by 0.6 years.

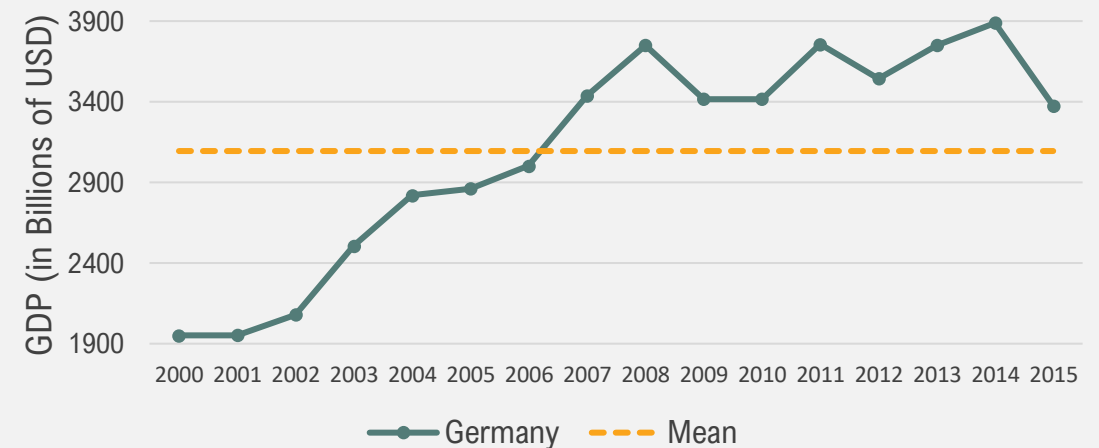
Their GDP, however, took off after 2002 with a nearly 35% increase between 2002 and 2004. Between the years 2002 and 2008, their GDP increased by 65%. Overall, their GDP experienced an increase of 73.1%.

Despite the fluctuations in GDP, German life expectancy continuously increased. *Are German GDP and life expectancy correlated?*

## Germany's Life Expectancy (2000-2015)



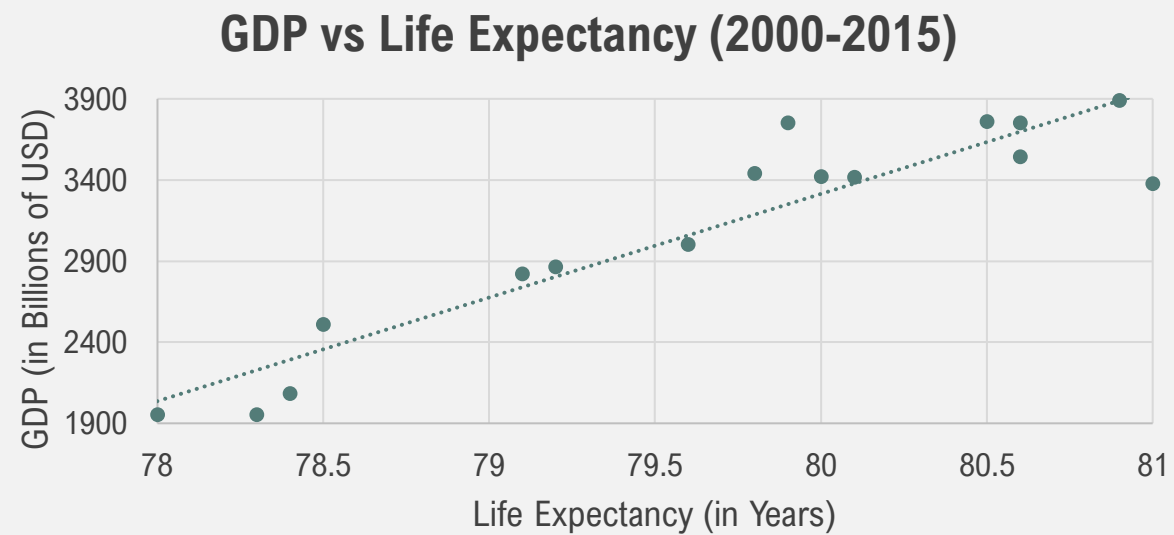
## Germany's GDP (2000-2015)



# COUNTRY ONE: GERMANY

We can see from the graph below that Germany's life expectancy and GDP follow a general pattern with life expectancy increasing as GDP does.

A Chi-Square Test was done to determine whether this general correlation was at all statistically significant. With a P-Value smaller than 0.05, we can confirm that the correlation between Germany's life expectancy and GDP is statistically significant.



LIFE EXPECTANCY (YEARS)	GDP (IN BILLIONS USD)
78	1949.9
78.3	1950.65
78.4	2079.14
78.5	2505.73
79.1	2819.25
79.2	2861.41
79.6	3002.45
79.8	3439.95
79.9	3752.37
80	3418.01
80.1	3417.09
80.5	3757.70
80.6	3543.98
80.6	3752.51
80.9	3890.61
81	3375.61

**P-Value:** 8.67\*10<sup>-8</sup> | Statistically Significant

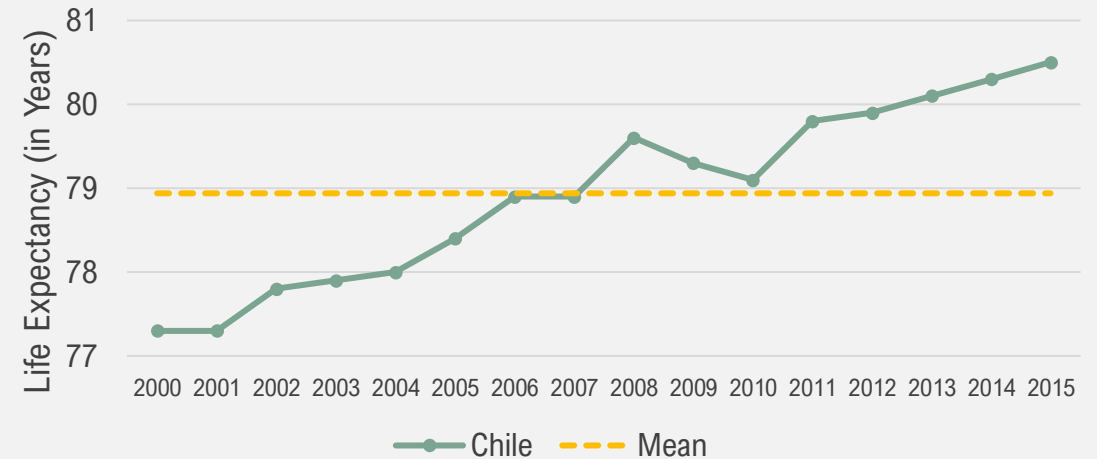
# COUNTRY TWO: CHILE

Chile's life expectancy dips in the years 2009 and again in 2010 before increasing for the rest of the years between 2011 and 2015. Overall, they experienced an increase of 3.2 years, or 4.1%, in their life expectancy.

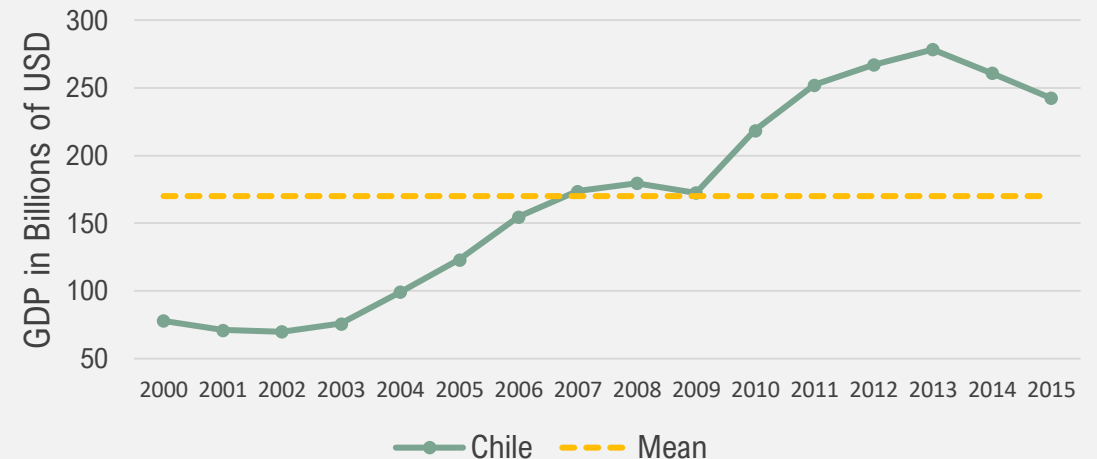
Their GDP dips between 2000 and 2003 dropping from 77.9 billion in 2000 down to 69.7 by 2002. Their highest GDP of 278.4 billion was reached in 2013 before decreasing again for the rest of the time period. From the year 2000 to the year 2015, they experienced an increase of 211.5%.

Looking at the separate graphs, it seems that Chile's life expectancy generally follows the trends of the GDP. *Are Chilean GDP and life expectancy correlated?*

## Chile's Life Expectancy (2000-2015)



## Chile's GDP (2000-2015)

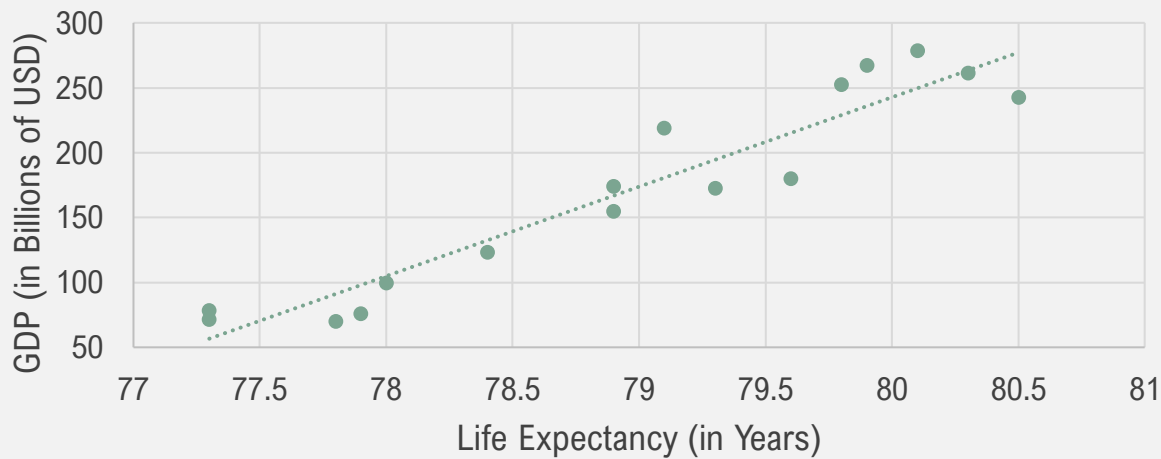


# COUNTRY TWO: CHILE

We can see from the graph below that Chile's life expectancy and GDP have a positive correlation. As their GDP increases, so does their life expectancy.

With a Chi-Square Test, we test whether the correlation is statistically significant. The test between Chile's life expectancy and GDP comes back with a P-Value smaller than 0.05, indicating that the positive correlation *is* statistically significant.

GDP vs Life Expectancy (2000-2015)



LIFE EXPECTANCY (YEARS)	GDP (IN BILLIONS USD)
77.3	77.86
77.3	70.98
77.8	69.74
77.9	75.64
78	99.21
78.4	122.97
78.9	154.79
78.9	173.61
79.6	179.64
79.3	172.39
79.1	218.54
79.8	252.25
79.9	267.12
80.1	278.38
80.3	260.99
80.5	242.52

**P-Value:**  $1.32 \times 10^{-60}$  | Statistically Significant



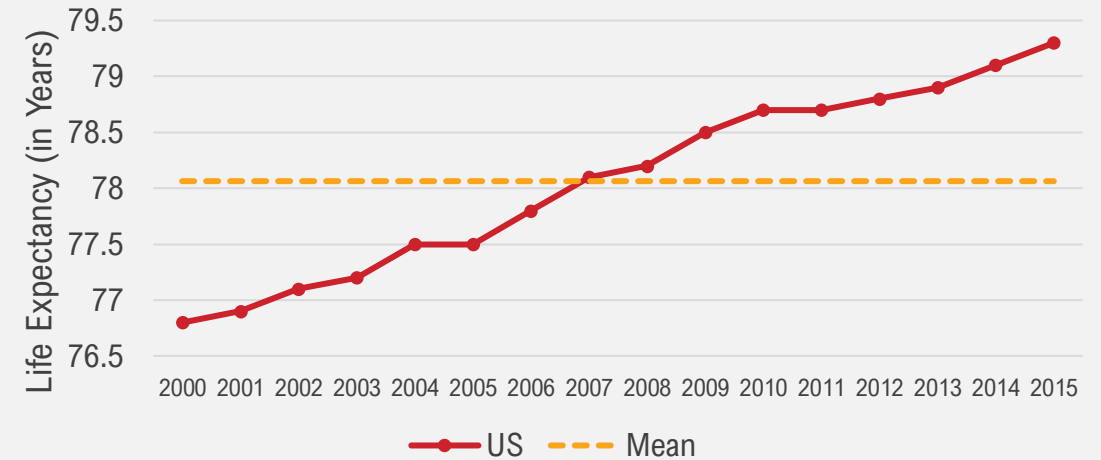
# COUNTRY THREE: UNITED STATES

The US's life expectancy, much like Germany's seems to steadily rise over the entire 16-year time period. However, it experiences smaller change with a total increase of only 3.3%. Their life expectancy is also only 3<sup>rd</sup> highest amongst the six countries, despite their considerably higher GDP.

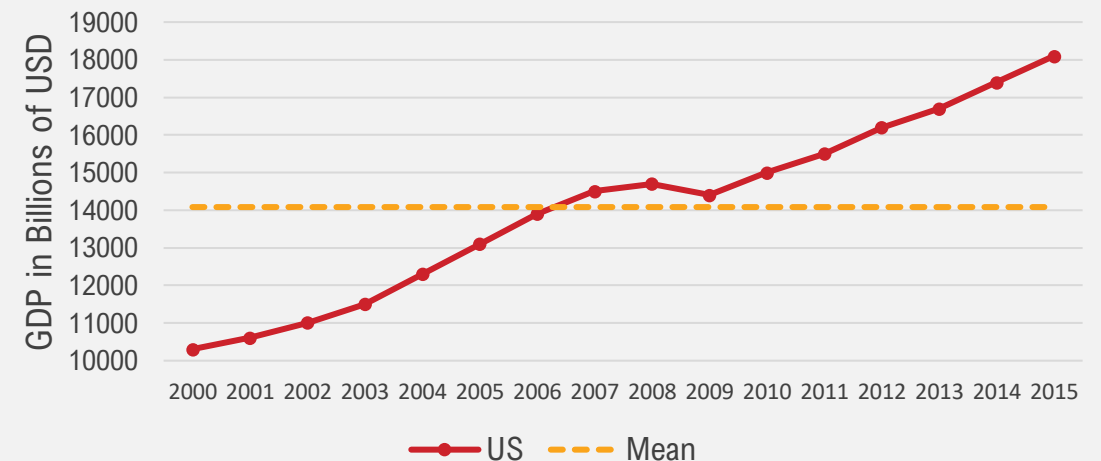
The US's GDP experiences a total increase of nearly 76% between 2000 and 2015. There's a slight dip in 2009, though their life expectancy continued to increase.

*Are American GDP and life expectancy correlated?*

## United States' Life Expectancy (2000-2015)



## United States' GDP (2000-2015)

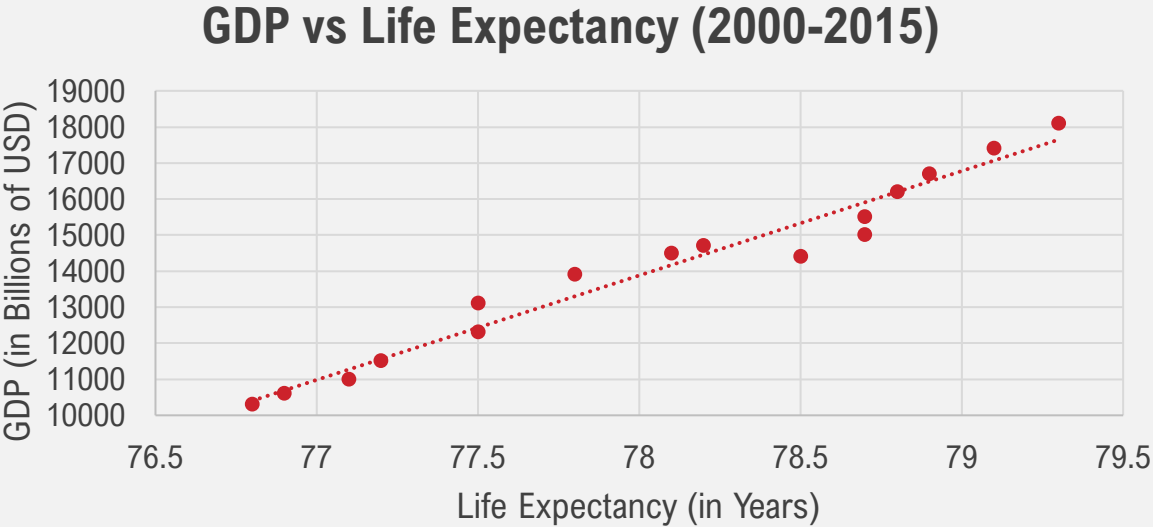


# COUNTRY THREE: UNITED STATES

The graph below for United States GDP vs Life Expectancy shows a positive correlation, once again.

The Chi-Square test for this country returned a P-Value of less than 0.05 - though it is the closest of any of the countries to 0.05 - so the correlation between US GDP and life expectancy is statistically significant.

LIFE EXPECTANCY (YEARS)	GDP (IN BILLIONS USD)
76.8	10300
76.9	10600
77.1	11000
77.2	11500
77.5	12300
77.5	13100
77.8	13900
78.1	14500
78.2	14700
78.5	14400
78.7	15000
78.7	15500
78.8	16200
78.9	16700
79.1	17400
79.3	18100



**P-Value:** 0.0047 | *Statistically Significant*

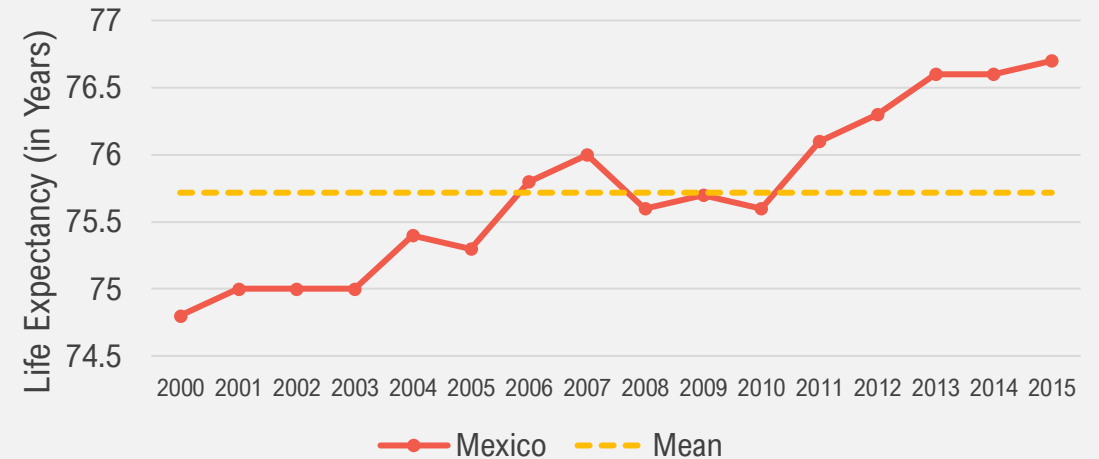
# COUNTRY FOUR: MEXICO

Mexico's life expectancy seems to fall and rise a bit more haphazardly than some of the other countries. Surrounding the 2009 dip in GDP, there is a decrease in their life expectancy as well. Overall, however, Mexico still experienced an increase in life expectancy, but the smallest of all six countries with only +2.5%.

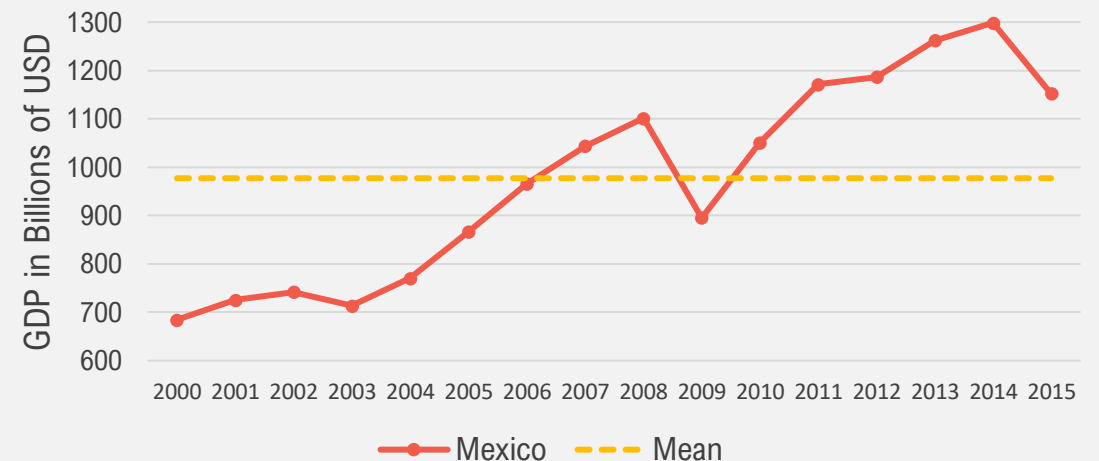
After a dip in 2003, Mexico's GDP sharply increases until 2008, after which it experiences a sharp decline. It springs back up again in 2010, though not for long as we can see they end the 16-year time period with one final decline. From 2003 to 2008, Mexico experiences an increase of over 50%. Overall, they experience the smallest increase in GDP as well, with only about a 69% increase.

*Are Mexican GDP and life expectancy correlated?*

**Life Expectancy by Country (2000-2015)**

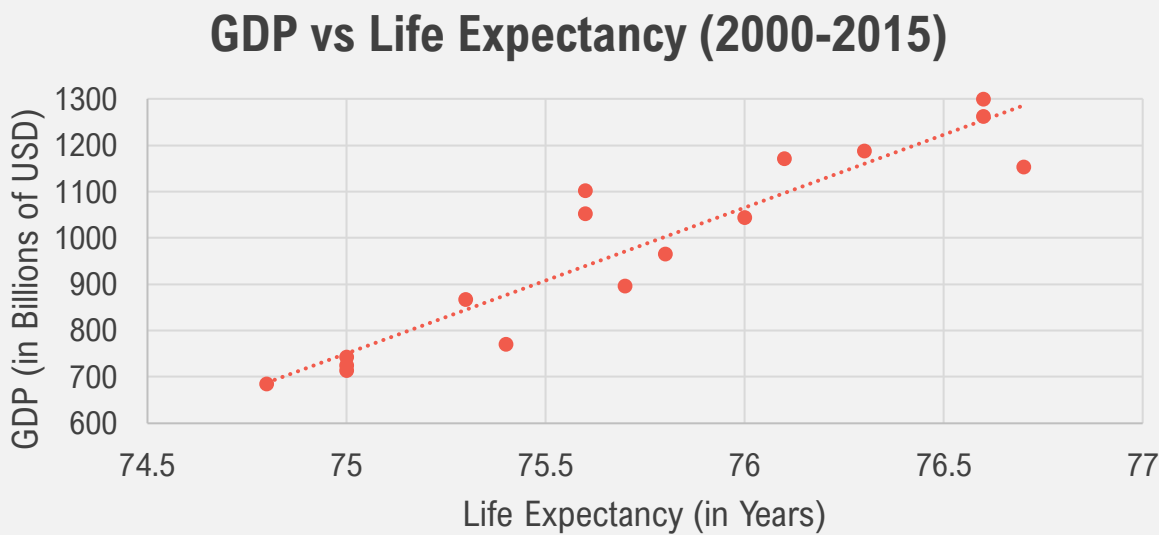


**GDP by Country (2000-2015)**



# COUNTRY FOUR: MEXICO

Mexico’s graph of GDP vs Life Expectancy shows a positive correlation. The P-Value result from their Chi-Square Test – much lower than 0.05 – shows that this positive correlation is also statistically significant for Mexico.



Life Expectancy (Years)	GDP (in Billions USD)
74.8	683.65
75	724.70
75	741.56
75	713.28
75.4	770.27
75.3	866.35
75.8	965.28
76	1043.47
75.6	1101.28
75.7	894.95
75.6	1051.13
76.1	1171.19
76.3	1186.60
76.6	1261.98
76.6	1298.46
76.7	1152.26

**P-Value:** 4.93\*10<sup>-6</sup> | Statistically Significant

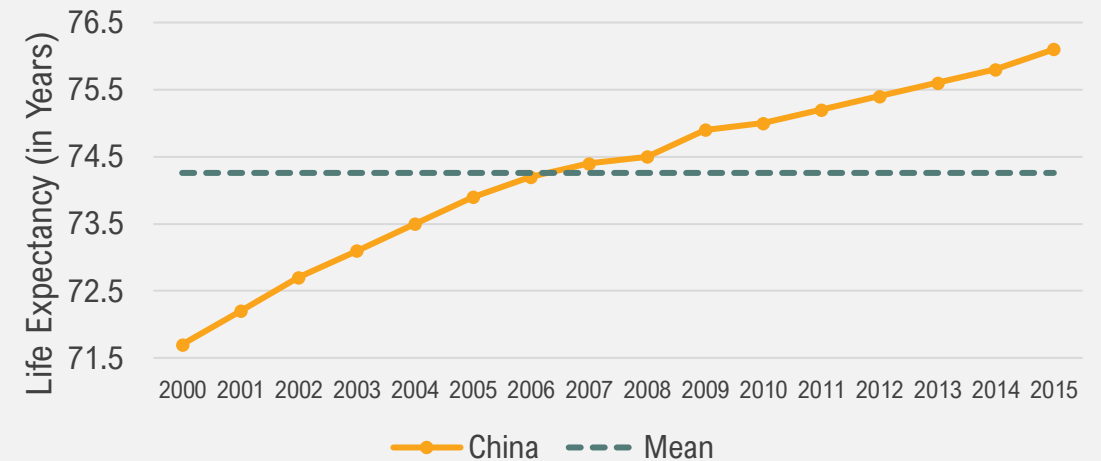
# COUNTRY FIVE: CHINA

China's life expectancy, like Germany's, seems to rise steadily. They experience a slight plateau between 2007 and 2008, only increasing by 0.1 years. From 2000 to 2015, China sees a total increase of 4.4 years or 6.1%. This makes it the second largest increase in life expectancy of all six countries.

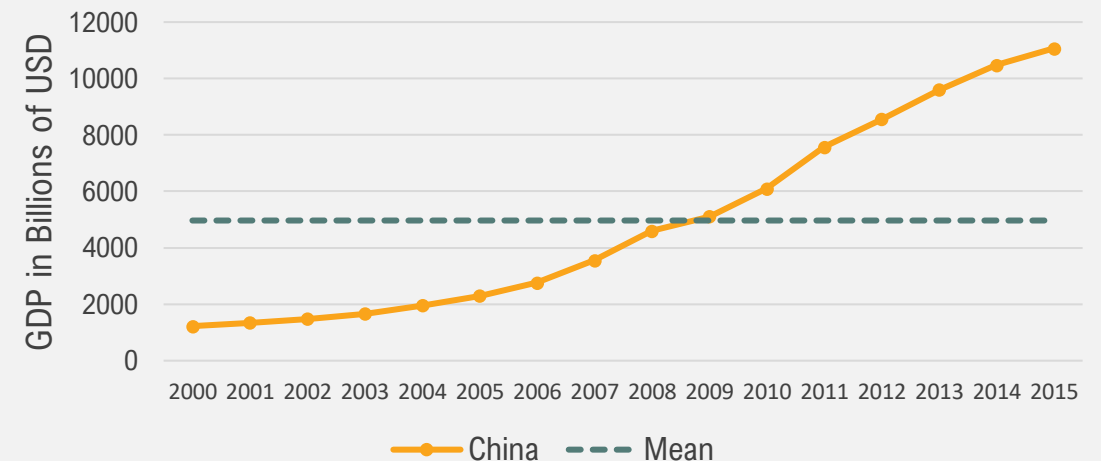
China's GDP also seems to rise steadily across the 16 years. They are the country with the largest increase in GDP of all six countries with an overall increase of about 813%.

*Are Chinese GDP and life expectancy correlated?*

## Life Expectancy by Country (2000-2015)



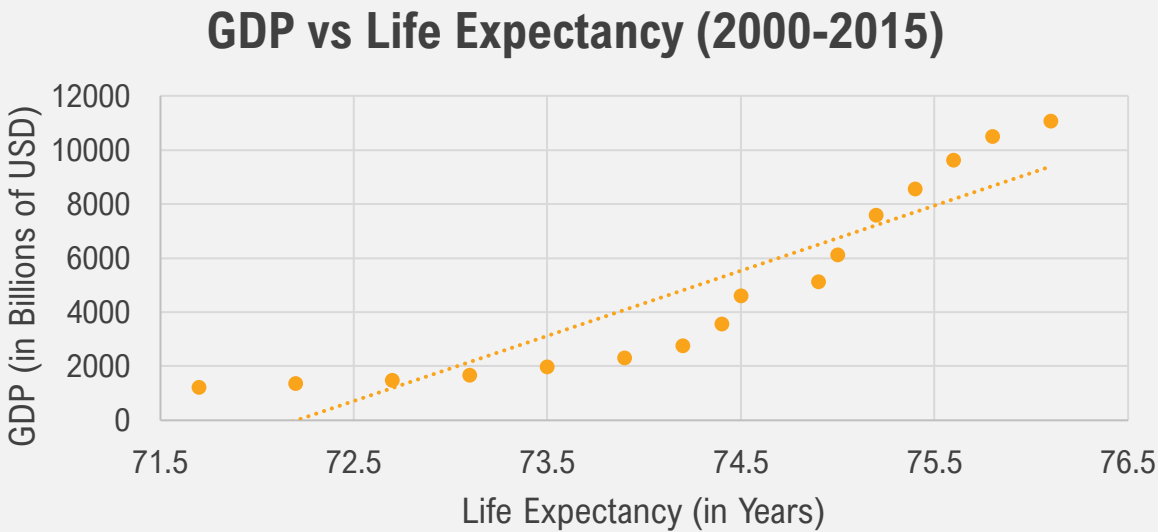
## GDP by Country (2000-2015)



# COUNTRY FIVE: CHINA

The graph below looks a bit different from other countries we've looked at so far. Even smaller increases in China's GDP saw comparatively large increases in their life expectancy. Though there is still a positive correlation evident.

The P-Value of China's Chi-Square Test shows that the correlation between their GDP and Life Expectancy is statistically significant.



LIFE EXPECTANCY (YEARS)	GDP (IN BILLIONS USD)
71.7	1211.35
72.2	1339.4
72.7	1470.55
73.1	1660.29
73.5	1955.35
73.9	2285.97
74.2	2752.13
74.4	3552.18
74.5	4598.21
74.9	5109.95
75	6100.62
75.2	7572.55
75.4	8560.55
75.6	9607.22
75.8	10482.4
76.1	11064.7

**P-Value:**  $2.18 \times 10^{-163}$  | Statistically Significant

# COUNTRY SIX: ZIMBABWE

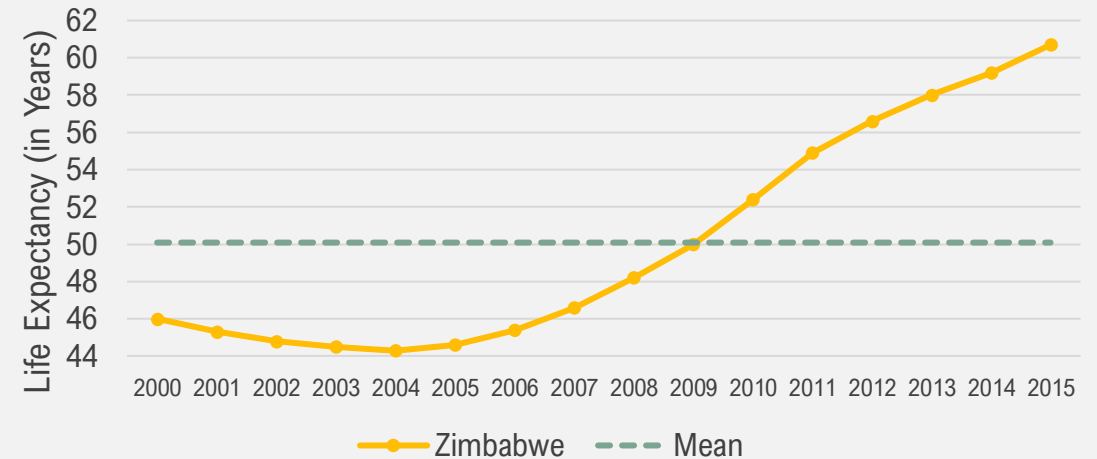
Zimbabwe's overall life expectancy is quite low.

Their life expectancies for each year are the lowest of all six countries. However, despite the dip from 2000 to 2004, they experienced quite a large increase in life expectancy over the 16 years. Overall, Zimbabwe's life expectancy increase by 14.7 years, a nearly 32% increase from the year 2000.

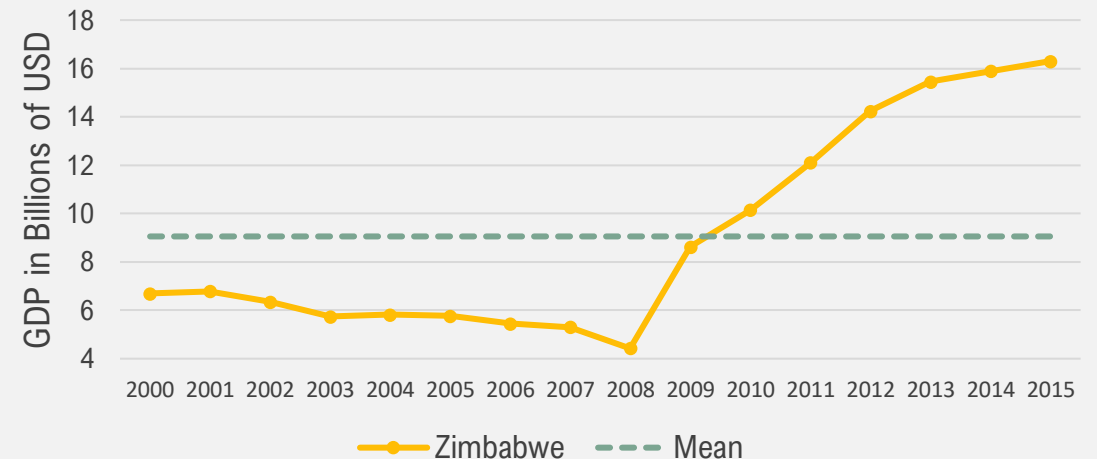
Their GDP also dips in the initial years, from 2000 to 2008, after which we see a sharp increase in 2009, nearly doubling their GDP. Zimbabwe has the third highest increase in GDP, from 6.7 billion USD to 16.3 billion USD, more than doubling their GDP in just 16 years. Their overall increase measures up to nearly 144%.

*Are Zimbabwean GDP and life expectancy correlated?*

## Life Expectancy by Country (2000-2015)



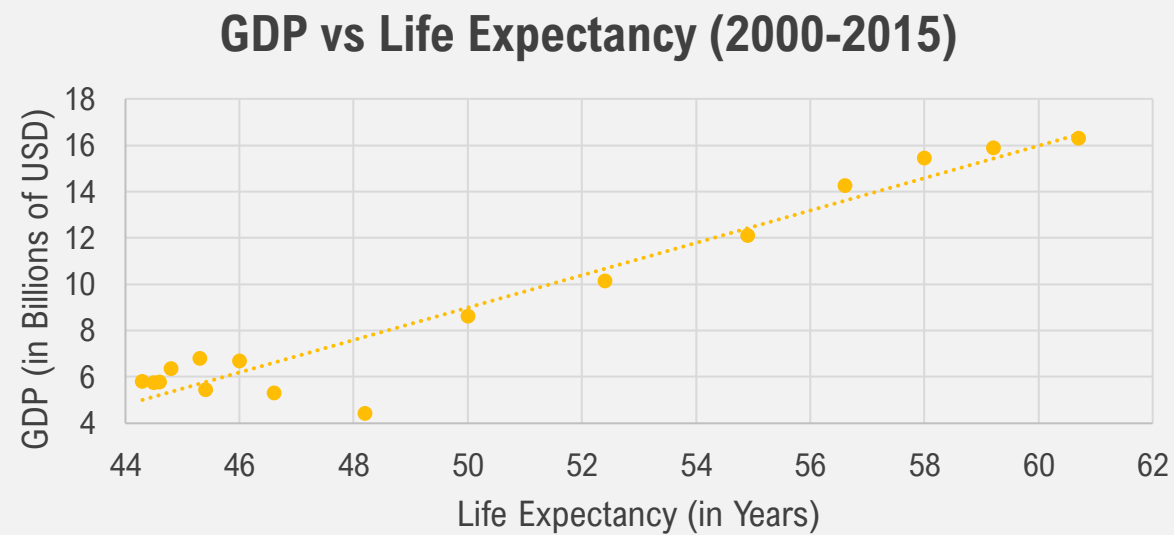
## GDP by Country (2000-2015)



# COUNTRY SIX: ZIMBABWE

Zimbabwe’s graph of GDP vs Life Expectancy shows a positive correlation, much like the other five countries examined. There seems to be a positive correlation for this country’s GDP and life expectancy too.

According to the Chi-Square Test, the correlation between GDP and Life Expectancy for Zimbabwe is statistically significant.



LIFE EXPECTANCY (YEARS)	GDP (IN BILLIONS USD)
46	6.69
45.3	6.78
44.8	6.34
44.5	5.73
44.3	5.81
44.6	5.76
45.4	5.44
46.6	5.29
48.2	4.42
50	8.62
52.4	10.14
54.9	12.10
56.6	14.24
58	15.45
59.2	15.89
60.7	16.30

**P-Value:** 1.80\*10<sup>-14</sup> | Statistically Significant



# CONCLUSIONS

**HIGHEST LIFE EXPECTANCY  
OVERAL**

Germany

**HIGHEST GDP  
OVERALL**

United States

**GREATEST OVERALL LIFE  
EXPECTANCY INCREASE**

Zimbabwe  
+32%

**GREATEST OVERALL GDP  
INCREASE**

China  
+813%

**LOWEST LIFE EXPECTANCY  
OVERAL**

Zimbabwe

**LOWEST GDP  
OVERALL**

Zimbabwe

**SMALLEST OVERALL LIFE  
EXPECTANCY INCREASE**

Mexico  
+2.6%

**SMALLEST OVERALL GDP  
INCREASE**

Mexico  
+69%

- The life expectancies and GDPs of all countries are correlated, and that correlation is statistically significant for all of them as well.
- Despite having the highest GDP across the board, the United States only has the 3<sup>rd</sup> highest life expectancy.
- Some other factors to explore further include climate and pollution, government and political stability, health care costs and availability, and cost of living.