Mini Project 1

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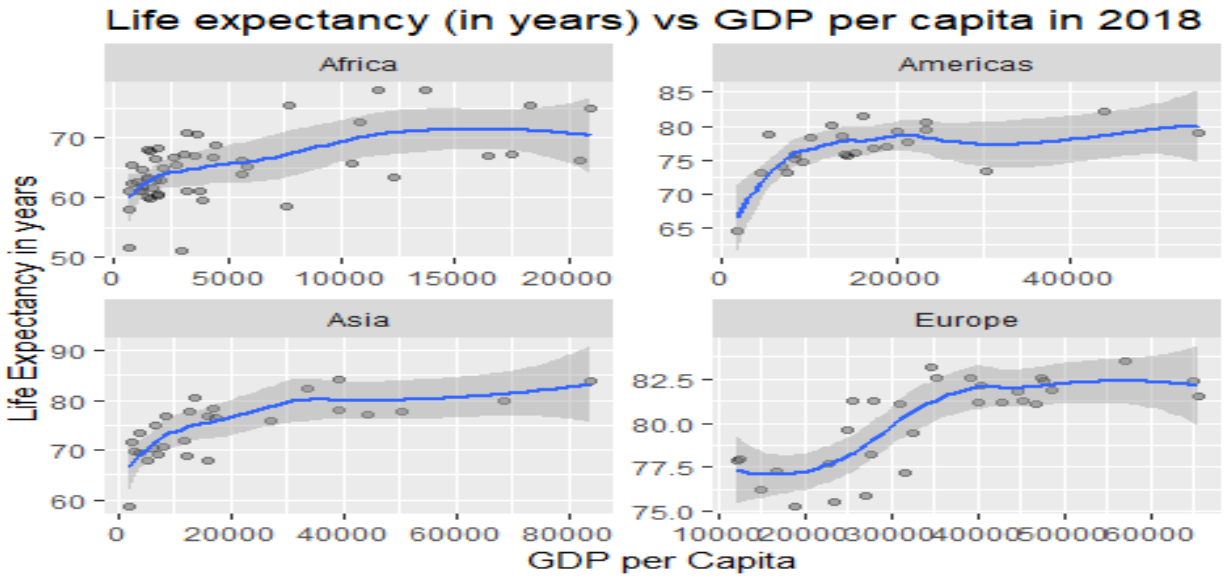
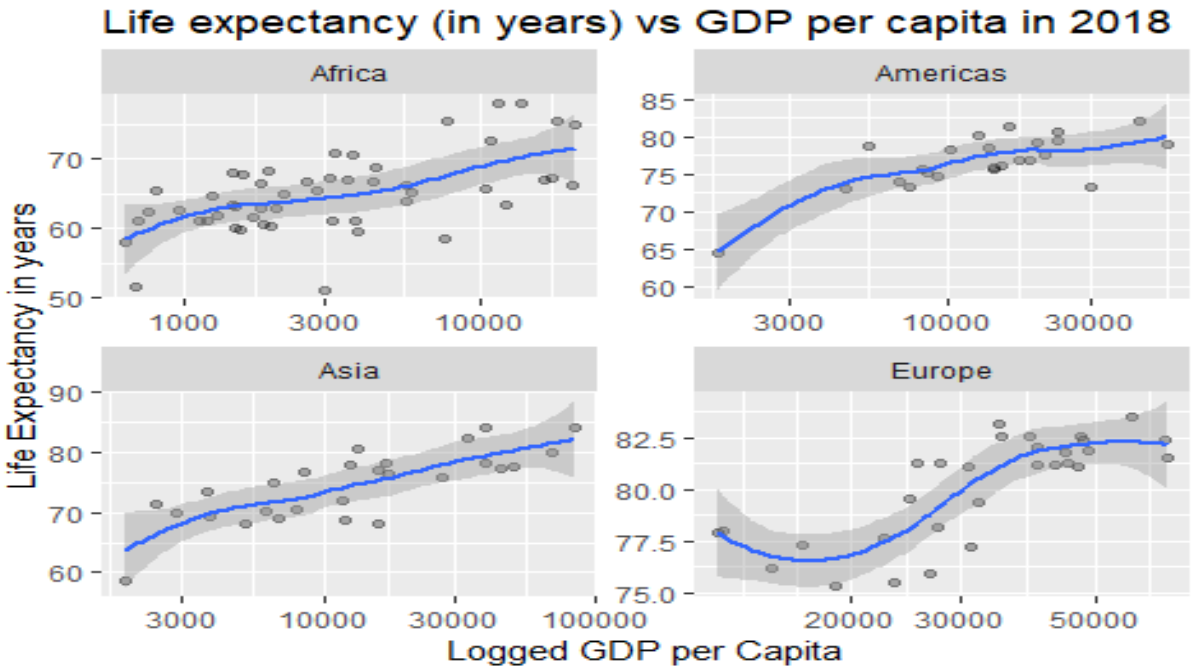
Question 1

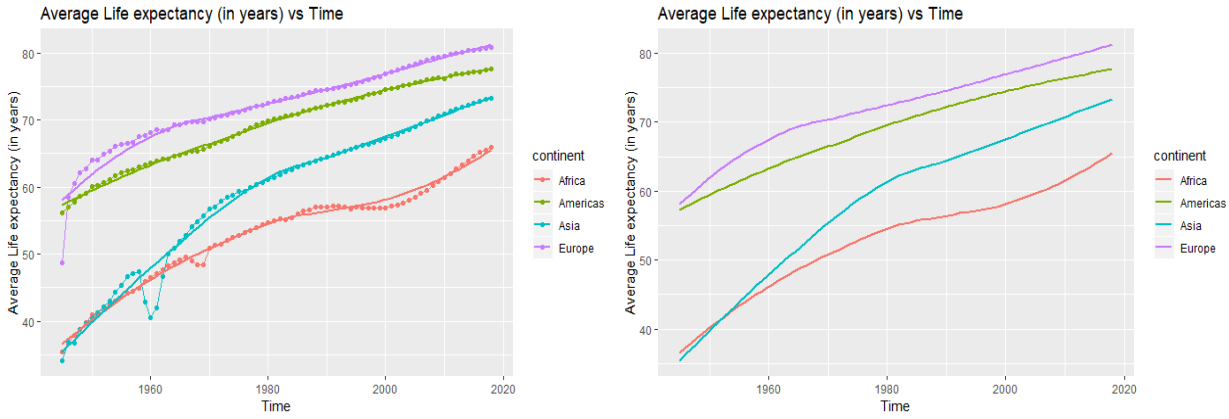




At a overall level we can observe that life expectancy increases with increase in GDP. The GDP values are very skewed so lets use a log transformation to improve the spread. Looking at the log value of GDP Vs the life expectancy, For Africa and Asia a linear line is able to fit the data as well as a complex model like loess. For the Americas with the exception of the one country(one with the lowest GDP per capita) a linear relation is able to explain the data as well as a complex model.

The relation between GDP per capita and life expectancy follows a S-Shaped curve in Europe. For all continents except Europe, a linear line can fit the data quite similar to loess. Loess is a non-parametric approach that fits a polynomial through the data, it is an improvement over linear regression that fits only a straight line.

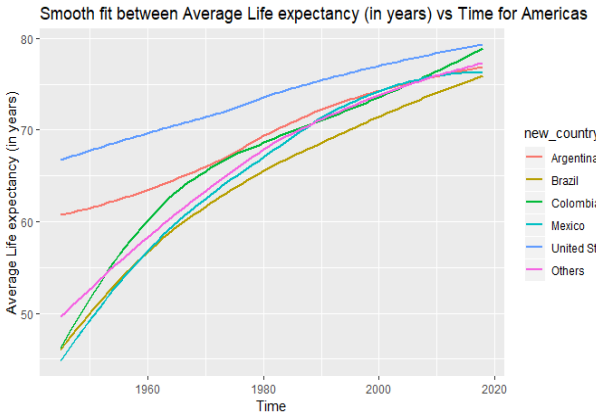
Question 2: Life expectancy over time by continent

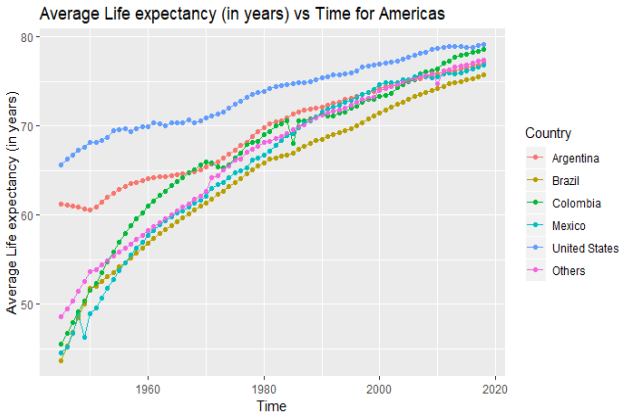


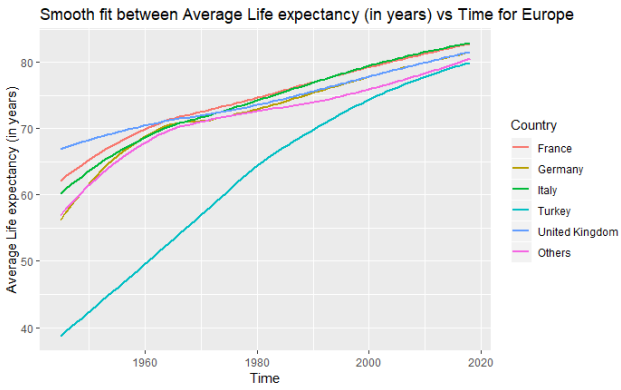
From the above image we can see that as the years progress the average life expectancy has improved for all continents. Europe has had the highest life expectancy followed by Americas, Asia and Africa. Over time the difference between the average life expectancy has decreased between the continents, this is especially true for Asia and Europe/Americas.

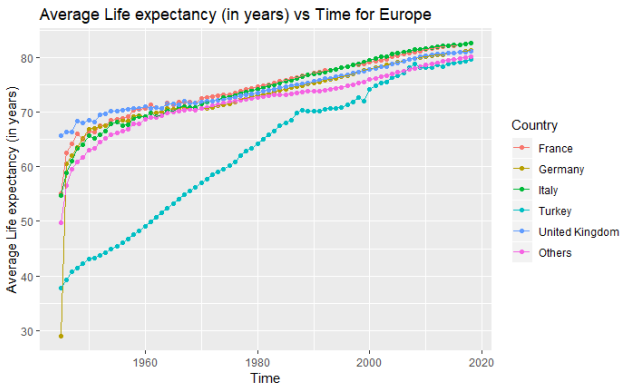
Europe and Americas both have higher life expectancies compared to Asia and Africa. The increase in life expectancies for Europe and Americas has been linear. For Asia there was a steep increase from 1945 till the 1980's then the climb was less steep but still linear. Africa started to grow linearly, then had a stagnation in the 1990's and is now showing an exponential rise.

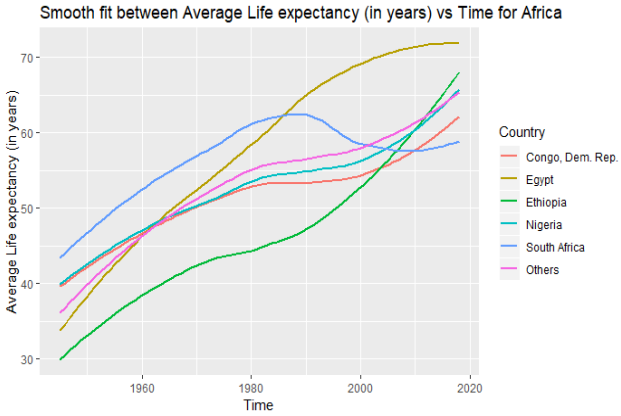
Now, let's look at each continent in more detail. Since there are a lot of counties within each continent we have selected the top 5 countries based on overall population and grouped the remaining counties into the other bucket.

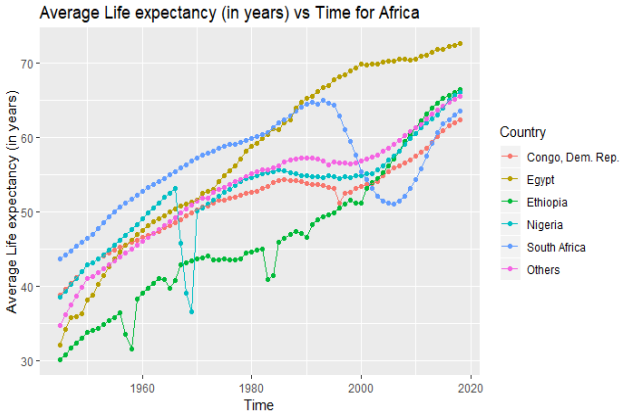

Smooth fit between Average Life expectancy (in years) vs Time for Americas
Average Life expectancy (in years)
Time
new_country
Argentina
Brazil
Colombia
Mexico
United States
Others

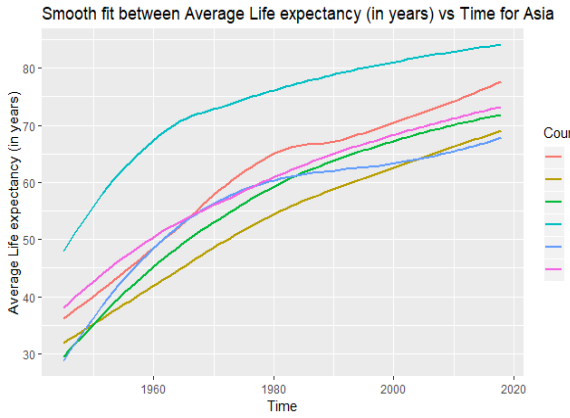

Average Life expectancy (in years) vs Time for Americas
Average Life expectancy (in years)
Time
Country
Argentina
Brazil
Colombia
Mexico
United States
Others

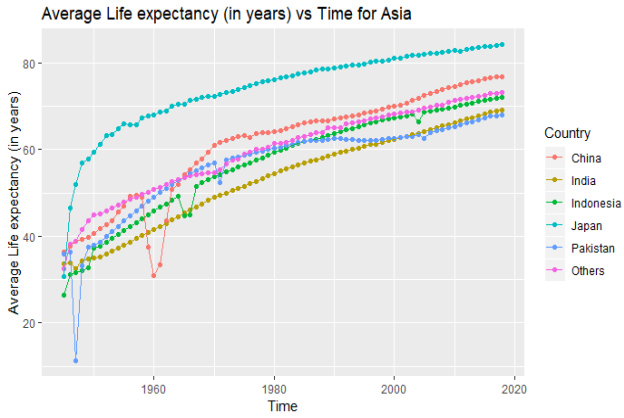

Smooth fit between Average Life expectancy (in years) vs Time for Europe
Average Life expectancy (in years)
Time
Country
France
Germany
Italy
Turkey
United Kingdom
Others


Average Life expectancy (in years) vs Time for Europe
Average Life expectancy (in years)
Time
Country
France
Germany
Italy
Turkey
United Kingdom
Others


Smooth fit between Average Life expectancy (in years) vs Time for Africa
Average Life expectancy (in years)
Time
Country
Congo, Dem. Rep.
Egypt
Ethiopia
Nigeria
South Africa
Others

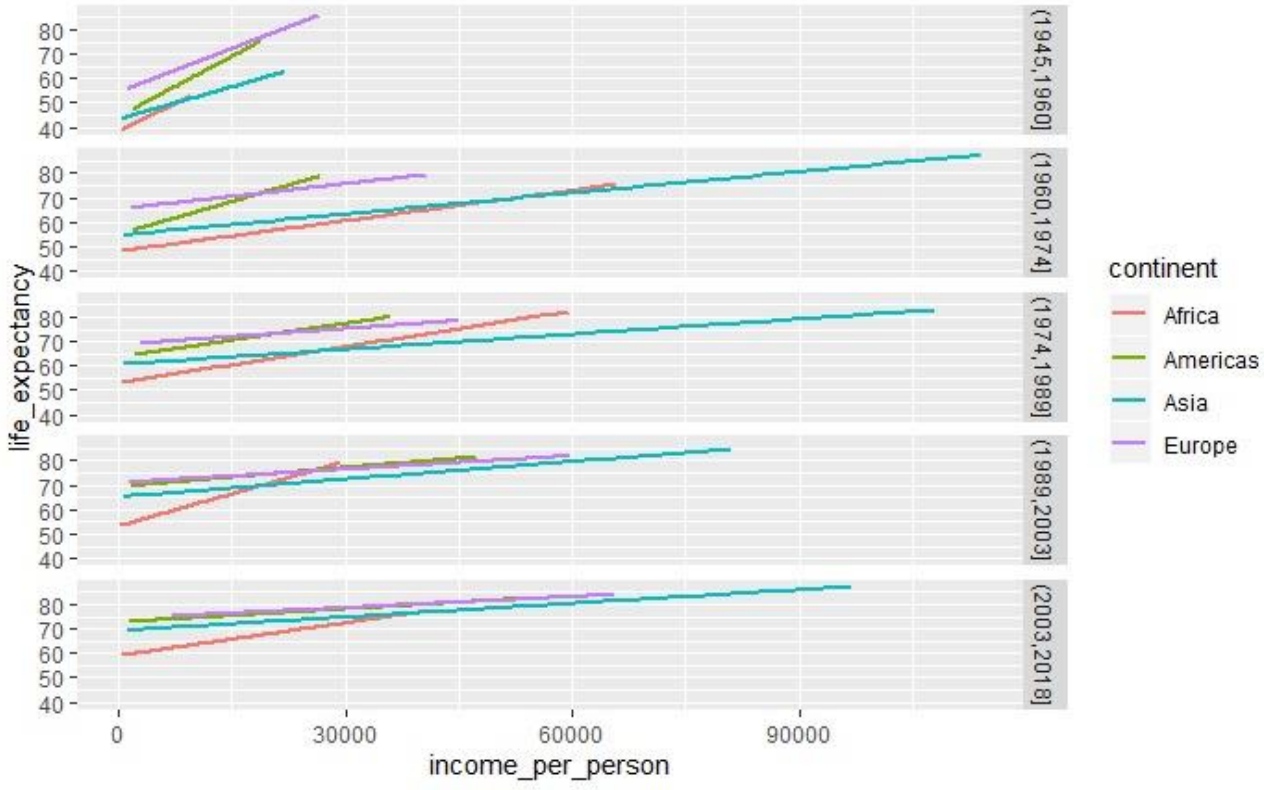

Average Life expectancy (in years) vs Time for Africa
Average Life expectancy (in years)
Time
Country
Congo, Dem. Rep.
Egypt
Ethiopia
Nigeria
South Africa
Others



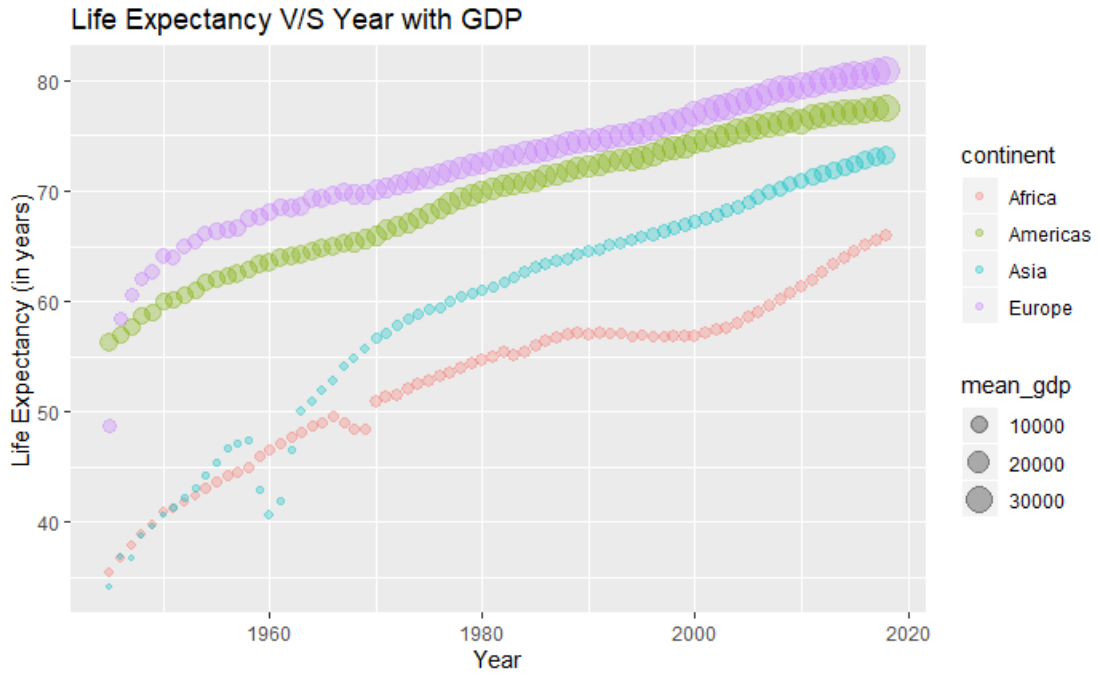


The growth for all the countries within Europe has been quite steady, Turkey had a very low Life expectancy after the world war 2 but had a steep linear increase and has caught up to the rest of Europe now . In Americas the United States leads all other countries in terms of life expectancy. The growth in Africa is a little bit more complex, Ethiopia has shown exponential increase, Egypt grew linearly until the 2000's and has plateaued since then. The flat portion observed in Africa in the 1990's is largely due to Nigeria, Congo and other countries.

Question 3



As we can see from the plots above, as the GDP per Capita (income per person) of the continent increases, life expectancy also increases. Over the years this relationship has changed. Prior to 1990's there was a linear relation between GDP and Life expectancy. The difference in the life expecatacy remained constant even with increase in GDP. As the years progressed the we can observe a convergence. After a certain threshold, increases in GDP don't increase the life expectancy by a big margin. After the 2000's the average life expectancy in all the continents have nearly converged.



We also show the relationship of Life expectancy with respect to Year. We can say that as time goes on, the Life Expectancy is increasing. However, the size of the bubbles (representing the GDP) is also increasing. To better understand this relation we plotted the graph below:

Conclusion

We can observed a linear relation between GDP per capita and Life expectancy for most of the continents except Europe till the 1990s and this relation has then started to coverage after that. We also that the Average life expectancy has improved over time for all continents and the gap between continents has decreased over time. The growth for every country within a continent is not similar, some counties had exponential growth whereas some even had a drop in life expectancy over time for a small period this was because of the political situation at that time.

Reference

1. https://en.wikipedia.org/wiki/Local_regression

2. https://www.statsdirect.com/help/nonparametric_methods/loess.htm

Appendix