GapMinder_Analysis

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[LINK TO OUTPUT FILE] (http://rpubs.com/haneefmrn/EDAGapminder)

Question

To measure the Income and Life expectance rate in different Geographic locations

Data Description

Country describes the primary variable describes the location of the life expectancy measured
Region describes the continent related to the country
Year - Provided for each country from 1800 to 2015
Life - Provided for each country by year
Population - Data available for each starting decade of each country
Income - Continous data series for each country by year

Income - Gross domestic product per person adjusted for differences in purchasing power (GDP/capita, PPP$ inflation adjusted)

Life - The average number of years a newborn child would live if current mortality pattern were to stay the same

population - Population for the given country in the given year (Source: GapMinder)

Data Preparation

Set working directory

Import the Raw data

Adding Required libraries

Summary of Data

Explore Data Analysis

Set working directory and Import raw data

```
setwd("~/Desktop/EXPL DATA ANALYSIS/EDA REPORT")
```

```
gapminder <- read.csv("gapminder.csv")
```

Required Libraries

```
library(dplyr)
```

```
## 
## Attaching package: 'dplyr'
## The following objects are masked from 'package:stats':
## 
##     filter, lag
## The following objects are masked from 'package:base':
## 
##     intersect, setdiff, setequal, union
```

```
library(ggplot2)
```

```
library(matrixStats)
```

```
##
## Attaching package: 'matrixStats'
## The following object is masked from 'package:dplyr':
##
##     count
library(scales)
```

Summary of data

```
#Summary of  Gapminder
summary(gapminder)
##                 Country           Year           life
##  Afghanistan        :  216   Min.   :1800   Min.   : 1.00
##  Albania            :  216   1st Qu.:1854   1st Qu.:31.00
##  Algeria            :  216   Median :1908   Median :35.12
##  Angola             :  216   Mean   :1907   Mean   :42.88
##  Antigua and Barbuda:  216   3rd Qu.:1962   3rd Qu.:55.60
##  Argentina          :  216   Max.   :2015   Max.   :84.10
##  (Other)            :39988
##    population        income                               region
##         :25817   Min.   :   142   America                   : 7961
##  121000 :    6   1st Qu.:   883   East Asia & Pacific       : 6256
##  14092  :    6   Median :  1450   Europe & Central Asia     :10468
##  1432000:    6   Mean   :  4571   Middle East & North Africa: 4309
##  229000 :    6   3rd Qu.:  3483   South Asia                : 1728
##  2574000:    6   Max.   :182668   Sub-Saharan Africa        :10562
##  (Other):15437   NA's   :2341
str(gapminder)
## 'data.frame':    41284 obs. of  6 variables:
##  $ Country   : Factor w/ 197 levels "Afghanistan",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ Year      : int  1800 1801 1802 1803 1804 1805 1806 1807 1808 1809 ...
##  $ life      : num  28.2 28.2 28.2 28.2 28.2 ...
##  $ population: Factor w/ 15260 levels "","1,005,328,574",..: 7490 1 1 1 1 1 1 1 1 ...
##  $ income    : int  603 603 603 603 603 603 603 603 603 603 ...
##  $ region    : Factor w/ 6 levels "America","East Asia & Pacific",..: 5 5 5 5 5 5 5 5 5 5 ...
```

Here, we study that Country, population, and income are Factors. Life and income are of num data type while year is of int datatype. We notice that population is a number but due to commas, it is turned a factor. hece we clean the data by removing the commas and creating another field as numeric. ### Study the scope

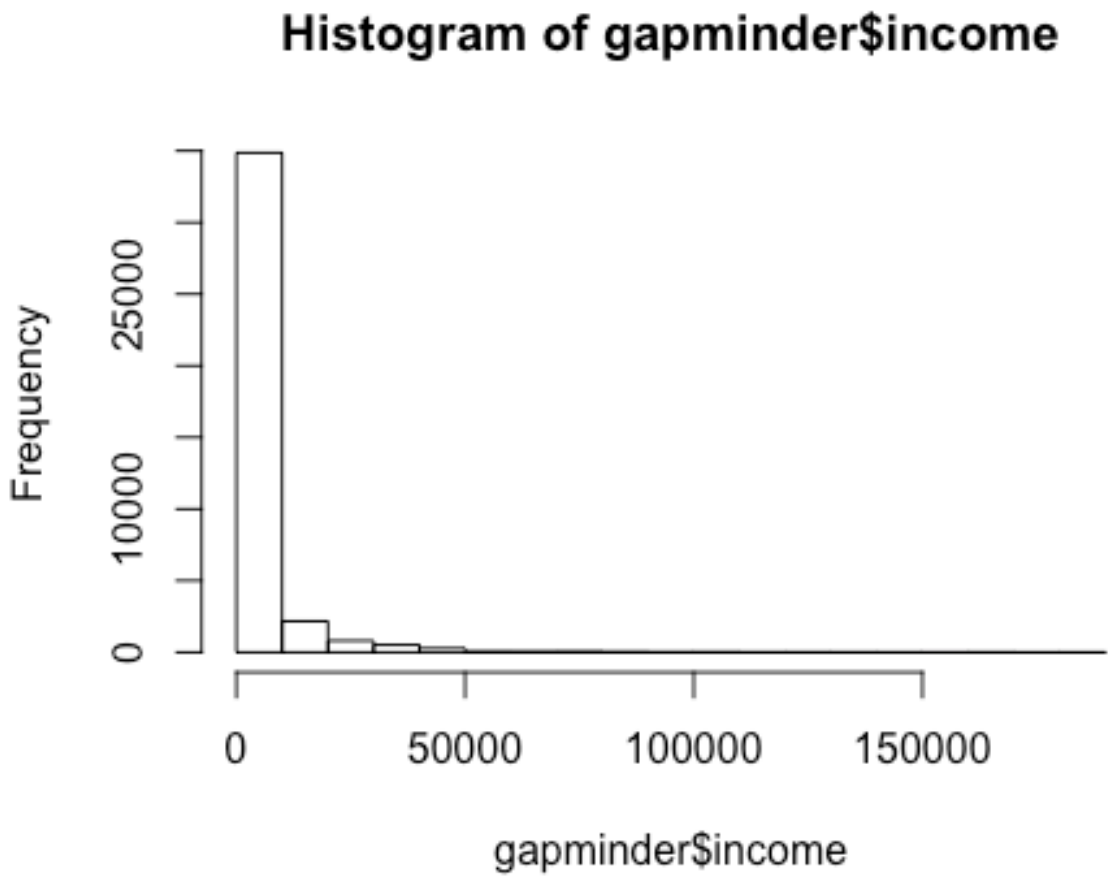
```
#Number of Unique Countries
length(unique(gapminder$Country))
## [1] 197
#Cleaning of population field. Removing commas and reloading as numeric in a different dataset
without NAs.
gapminder$population1 <- as.numeric(gsub(",","",gapminder$population))


gapminder1 <- gapminder %>% filter(!is.na(gapminder$population1))
```

Looking at the summary, now we know there are 197 countries spread across 6 regions, each having 216 entries for years from 1800 to 2015. The life expectancy ranges from 1 to 84%

Analysis

Income

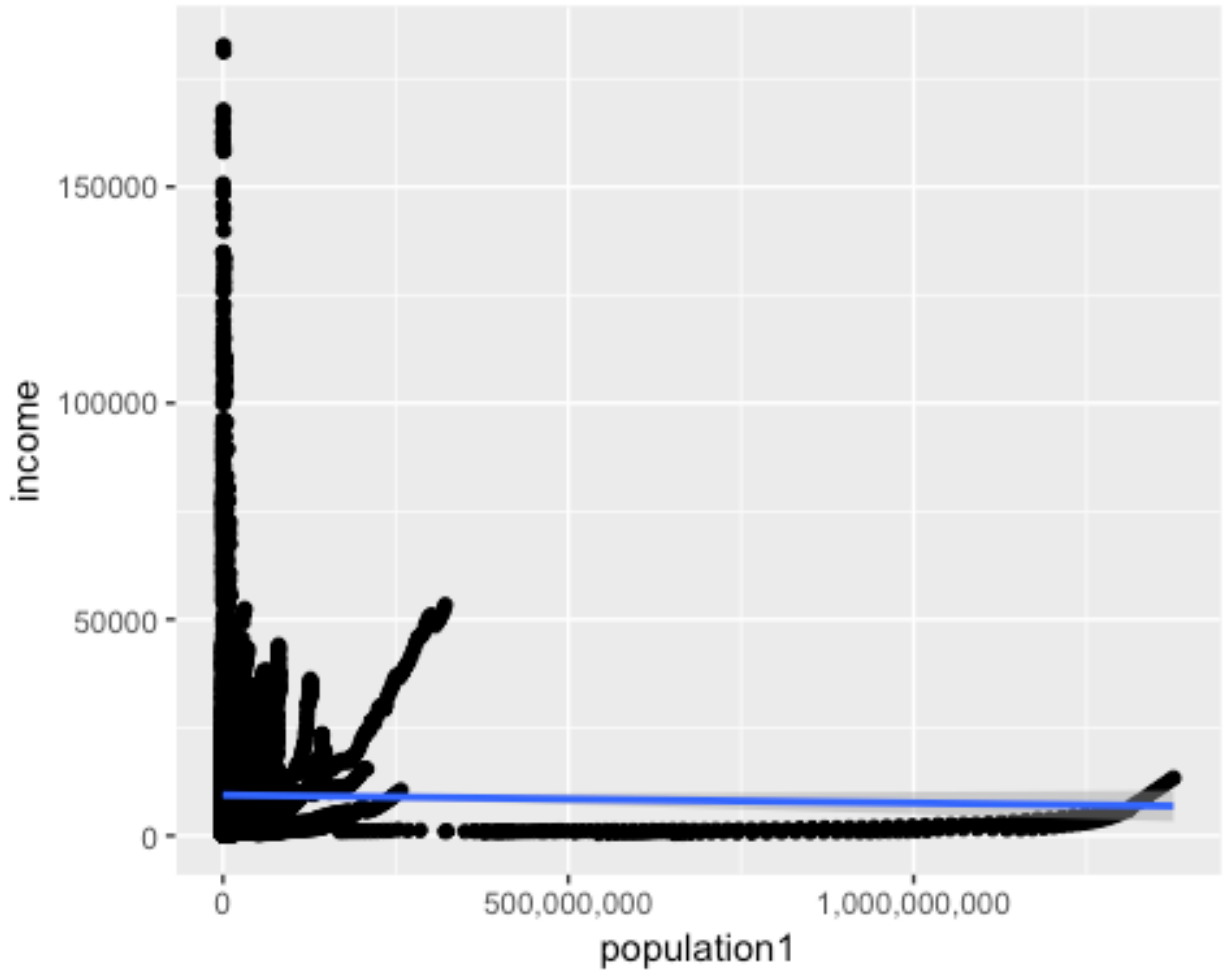
```
hist(gapminder$income)
```



Looking at the histogram, a high frequency of *income* lay in the range below **50,000.**

Specifically in 10,000 and reduces as we move towards 50,000.

```
summary(unique(gapminder$income))
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
##     142    2978    6651   12397   14744  182668       1
weightedMedian(gapminder$income, w = gapminder$region, na.rm = TRUE)
## [1] 1182
weightedMean(gapminder$income, w = gapminder$region, na.rm = TRUE)
## [1] 3900.356
d <- ggplot(gapminder1, aes(x = population1, y = income))
d + geom_point()+geom_smooth(method = "lm") + scale_x_continuous(labels = scales::comma)
## Warning: Removed 823 rows containing non-finite values (stat_smooth).
## Warning: Removed 823 rows containing missing values (geom_point).
```



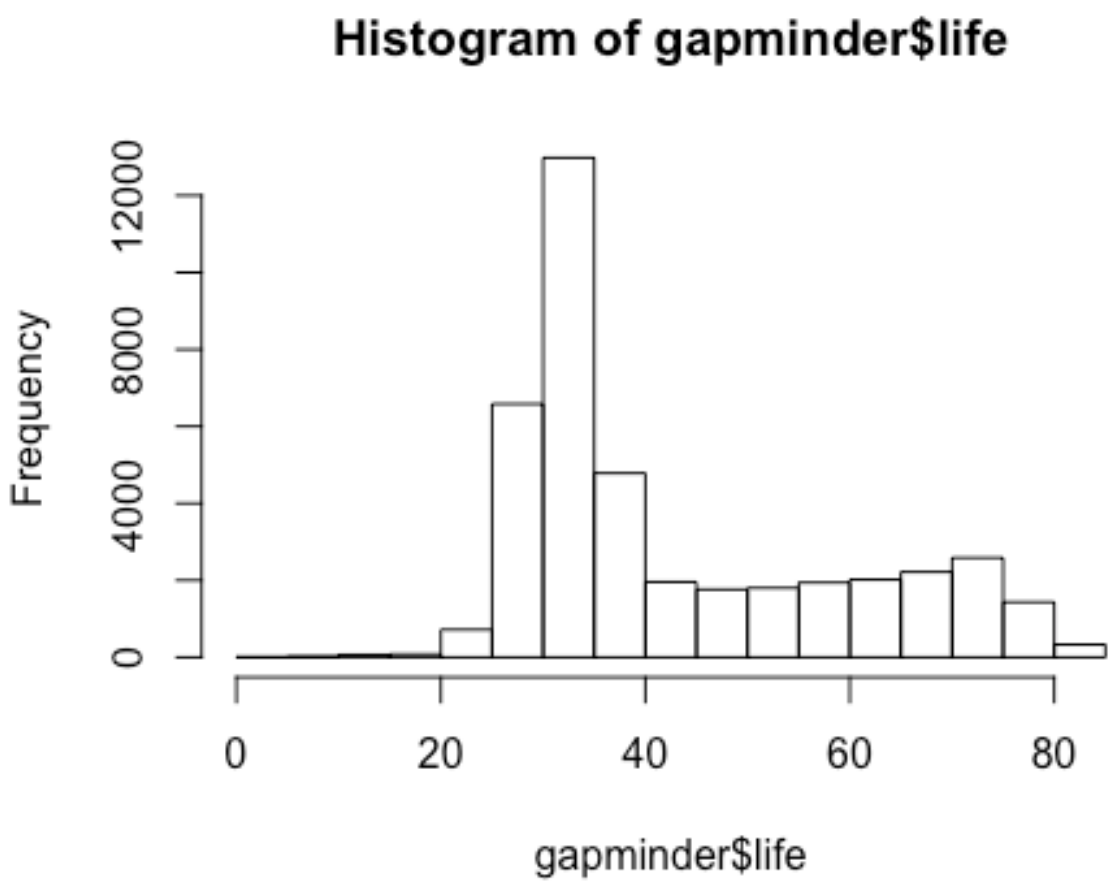
Further, when we look at the ranges summary, we find that the mean and the median lies in the 2nd quadrant with minimum value of 142 and maximum of 182668 However, things change drastically, when we look at the weighted median and weighted mean based on the*region*. the Median reduces from **6651** to **1457**, while the Mean reduces from **12397** to **4631. *We can say that the* income* ranges are different in different *regions*.

From the plot above (population vs income), we can also find that as the population increases, the income hardly increases for most, while is linear for some. However, if the population is lower always, the income increases exponentially.

###Life Expectancy

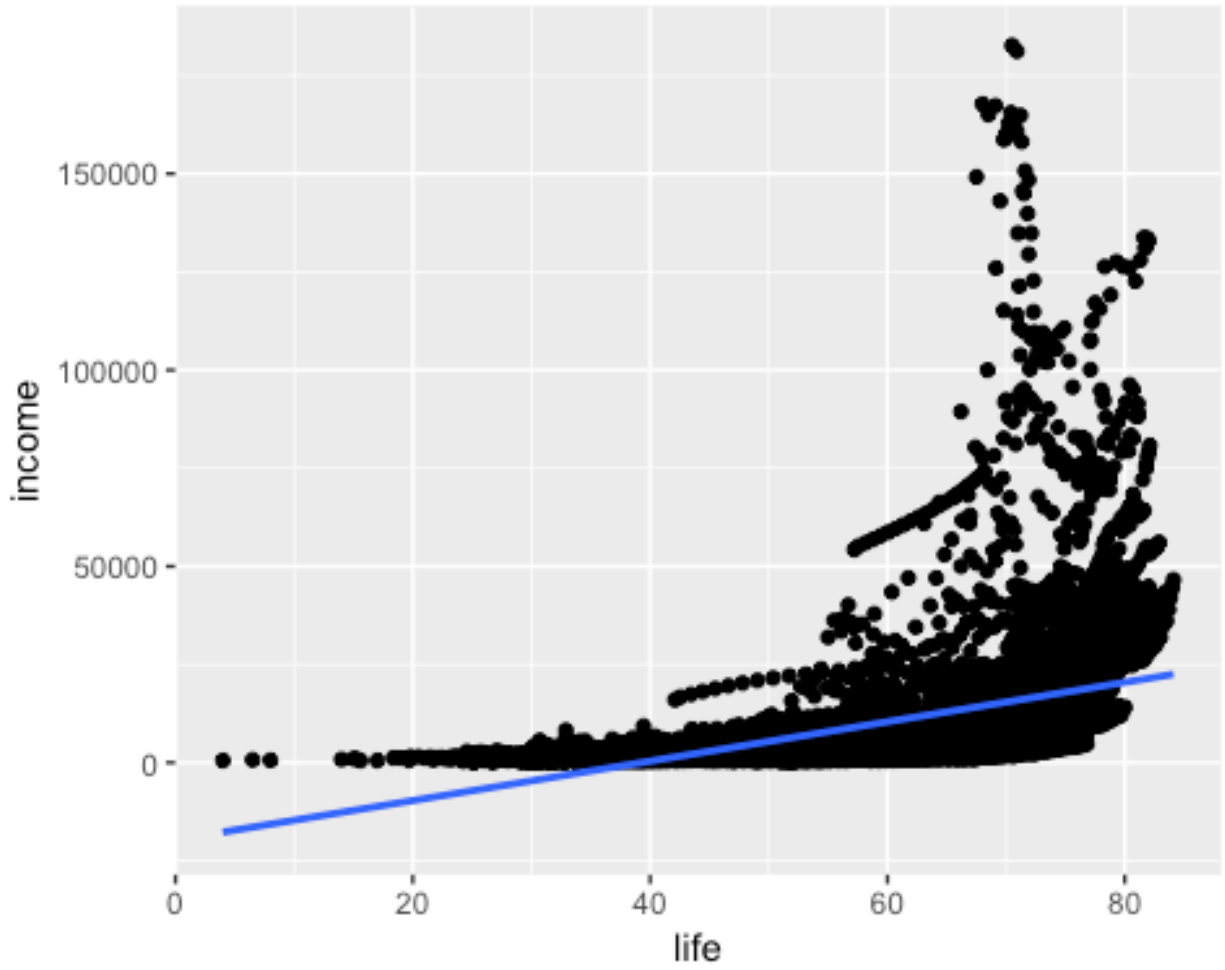
Let's look at the frequencies of the life expectancy and income ranges for the complete data

```
hist(gapminder$life)
```



The Histogram shows a very high life expectancy starting at 20, the highest being 20 to 40 and an average income of about 2000 as we observe towards 80.

```
summary(gapminder$life)
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    1.00   31.00   35.12   42.88   55.60   84.10
weightedMedian(gapminder$life, w = gapminder$region, na.rm = TRUE)
## [1] 33.86702
weightedMean(gapminder$life, w = gapminder$region, na.rm = TRUE)
## [1] 41.45024
e <- ggplot(gapminder1, aes(x = life, y = income))
e + geom_point()+geom_smooth(method = "lm") + scale_x_continuous(labels = scales::comma)
## Warning: Removed 823 rows containing non-finite values (stat_smooth).
## Warning: Removed 823 rows containing missing values (geom_point).
```



There seems to be a high frequency of *life expectancy* in the range of **25-35 years** In the next graph, we can see that the life expectancy grows regardless of the income growth. However, as the life expectancy grows past 60, there is a big growth in income.

Population

```
median(gapminder1$population1)
## [1] 3358089
mean(gapminder1$population1)
## [1] 21187964
weightedMedian(gapminder1$population1, w = gapminder1$Country, na.rm = TRUE)
## [1] 3474657
weightedMean(gapminder1$population1, w = gapminder1$Country, na.rm = TRUE)
## [1] 19078834
```

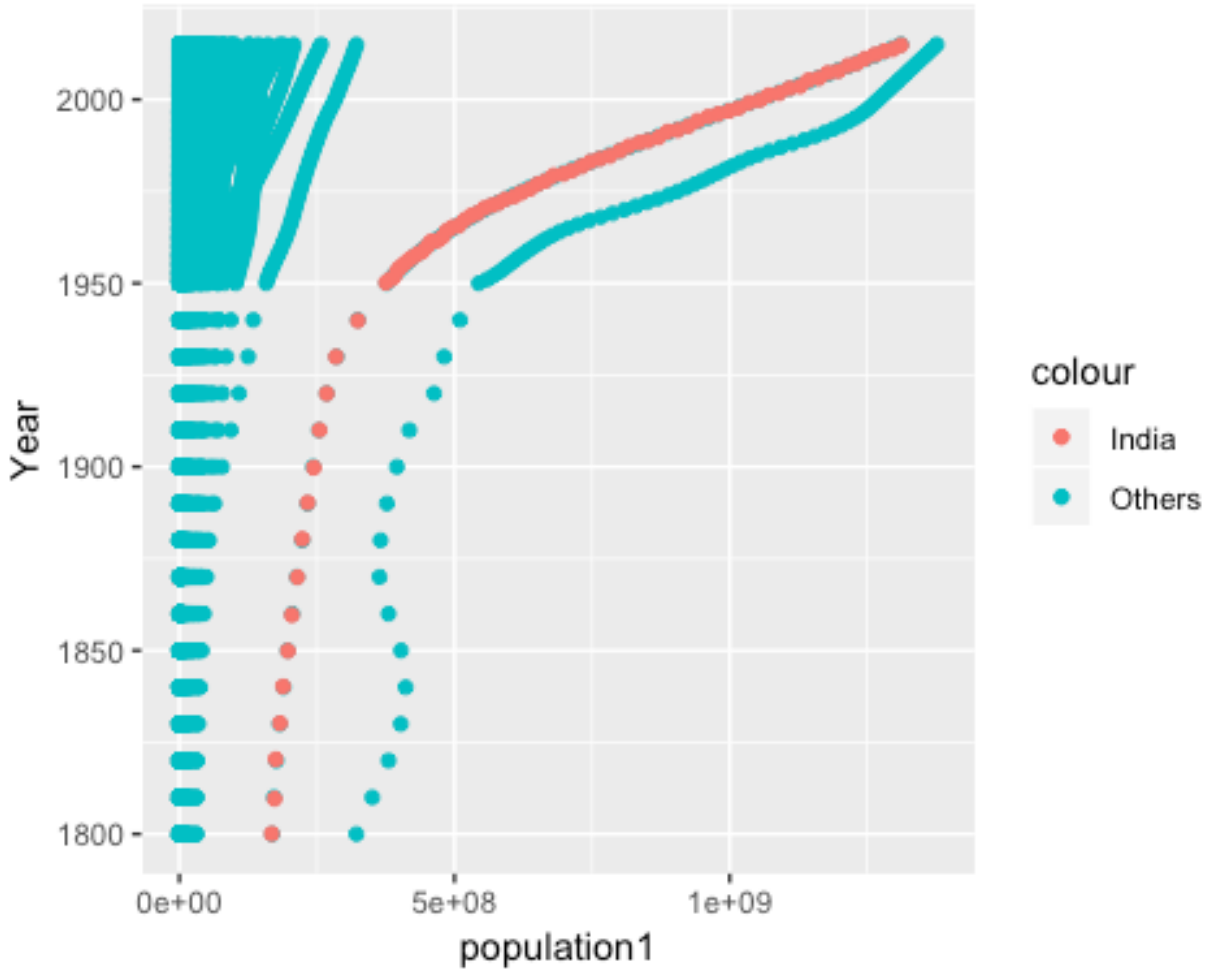
The weighted mean is much lower than that of the actual mean when Countries are considered. This mean that there is a big different between population of some countries.

```
p <- ggplot(gapminder1, aes(reorder(region, population1, FUN=function(x) mean(log10(x))),
population1))
p <- p + scale_y_log10()
p + geom_boxplot(outlier.colour="red") + geom_jitter(alpha=1/2)
```

Working with Country data

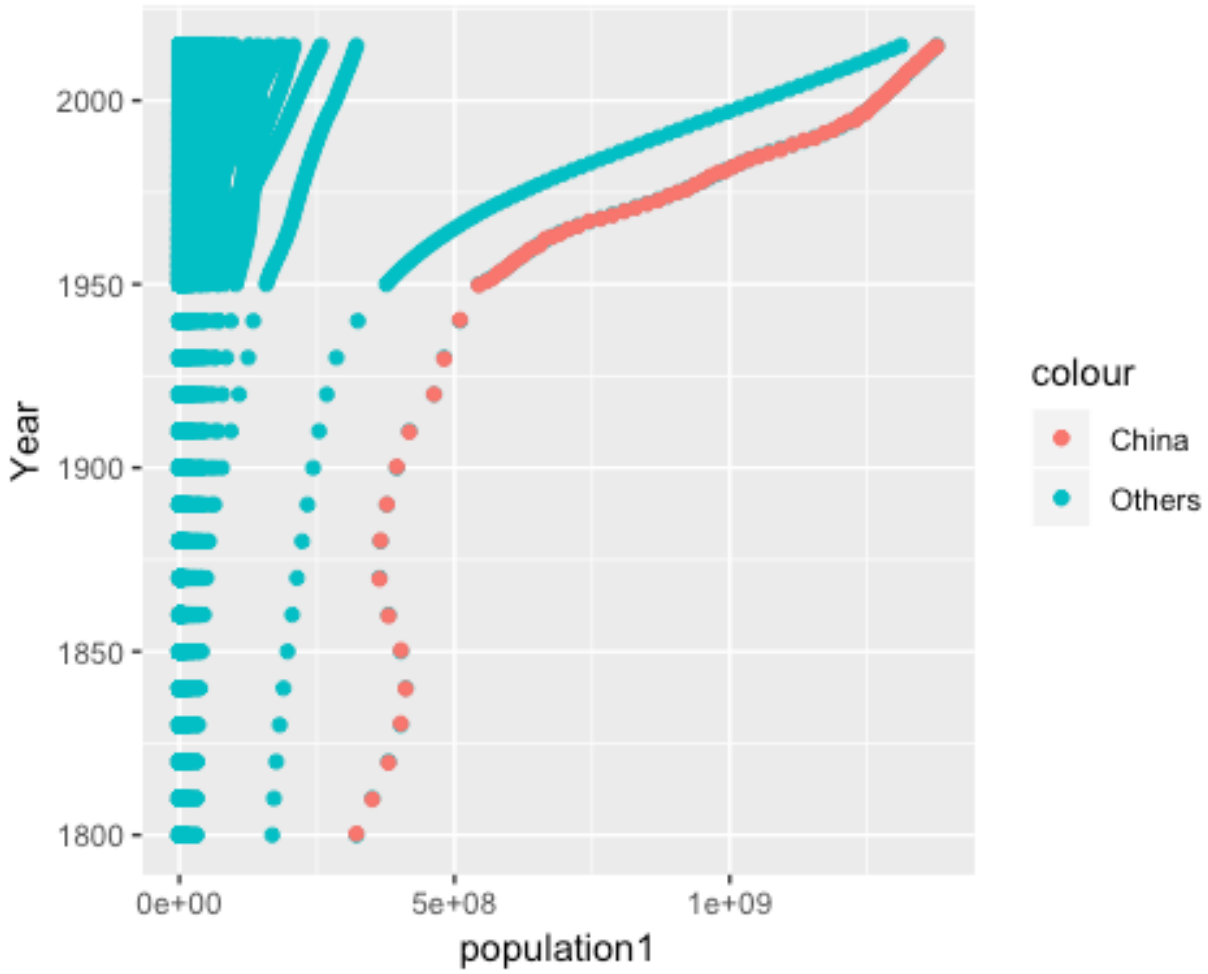
Comparison between India and China

```
# Creating subset of India Country
population_india <- gapminder1 %>% filter(Country=='India')
# Creating subset of India Country
population_china <- gapminder1 %>% filter(Country=='China')

ggplot(data= population_india, mapping
= aes(y=Year, x=population1, color="India"))  +geom_point(data
= gapminder1, aes(color="Others")) + geom_jitter()
```



Population observations between India and China on the rise starting from 1800, lets perform further analysis.

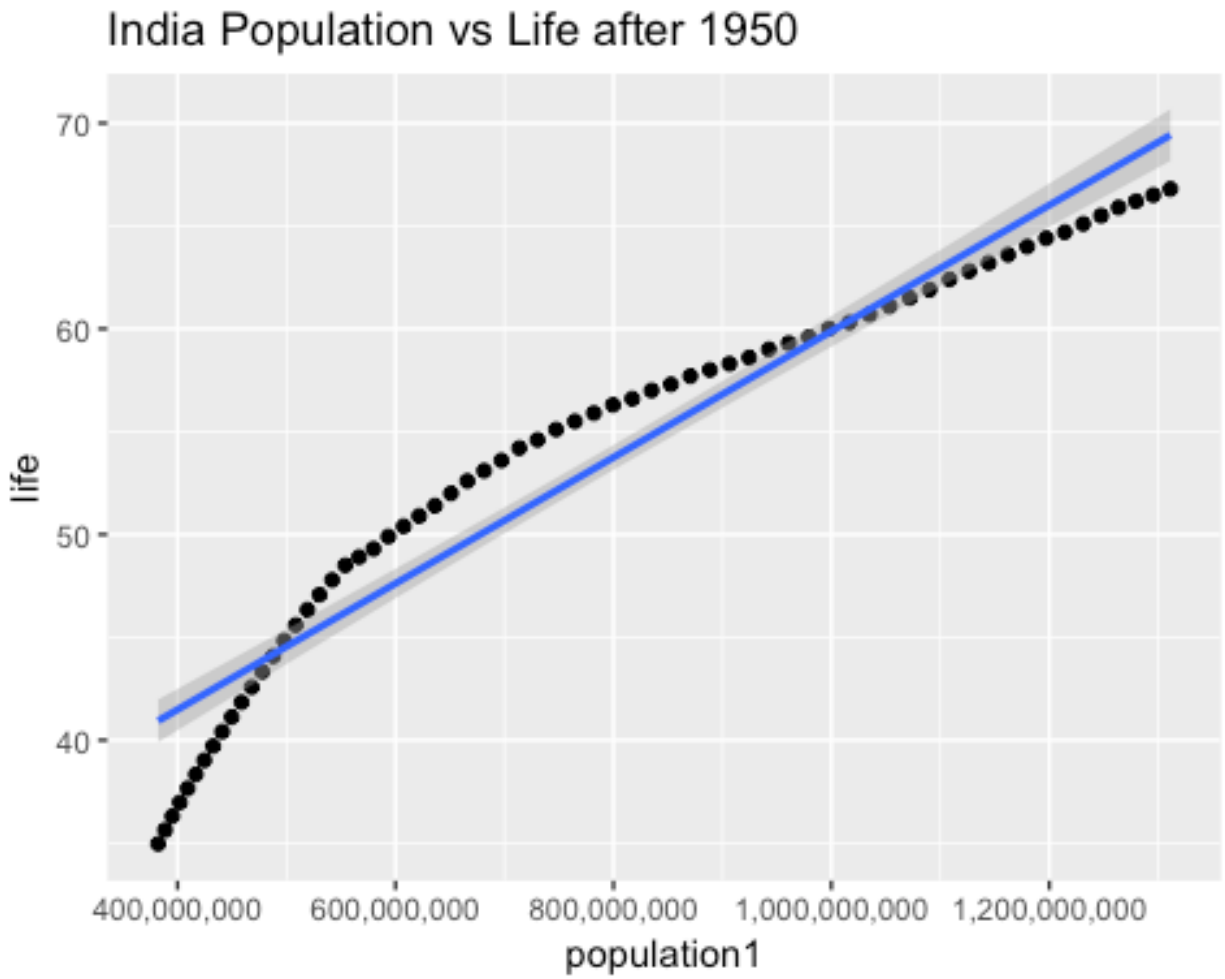
```
ggplot(data= population_china, mapping = aes(y=Year, x=population1, color="China")) +geom_point(data
= gapminder1, aes(color="Others")) + geom_jitter()
```



The population in India and China has risen exponentially after 1950 as compared to other countries.

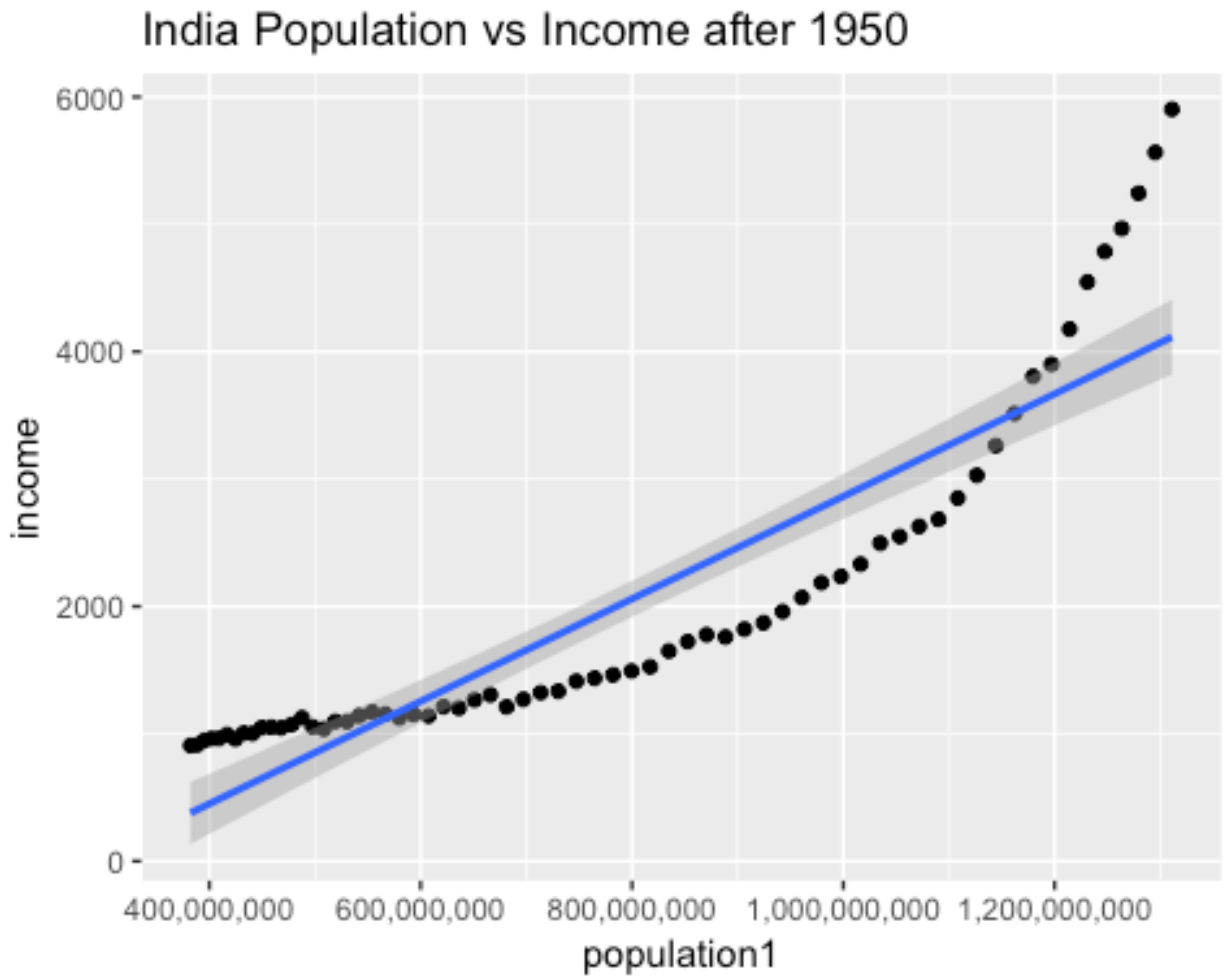
India and China after 1950

```
gapminder1 %>% #Filtering data for India
filter(Country=='India') %>%
summarize('LifeExpected (Mean) in India'=mean(population1),
'Population (Standard Deviation) in India'=sd(population1))
##   LifeExpected (Mean) in India Population (Standard Deviation) in India
## 1                    675758566                                 343006329
#Filtering data for India after 1950
pop_ind_after_1950 <- population_india %>% filter(Year > '1950')

b <- ggplot(pop_ind_after_1950, aes(x = population1, y = life))
b + geom_point()+geom_smooth(method = "lm") + scale_x_continuous(labels
= scales::comma) + labs(title="India Population vs Life after 1950")
```



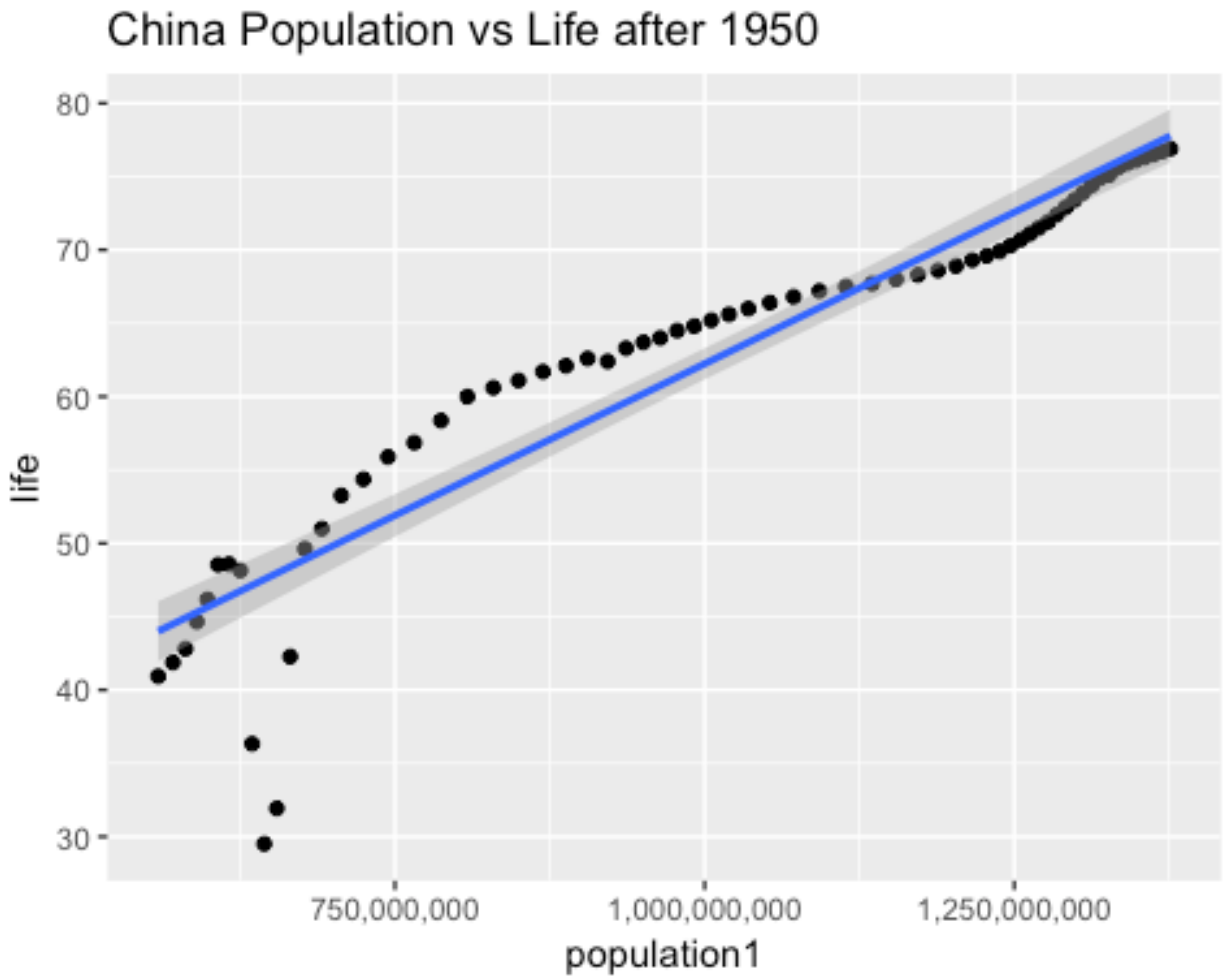
The graph above shows the Indian population vs Life, as we can see the age and population are increasing almost linearly, the population appears to be slightly high in age group 45 to 55 and steady increase, followed by a slight decrease after 65.

```
c <- ggplot(pop_ind_after_1950, aes(x = population1, y = income))
c + geom_point()+geom_smooth(method = "lm") + scale_x_continuous(labels
= scales::comma) + labs(title="India Population vs Income after 1950")
```



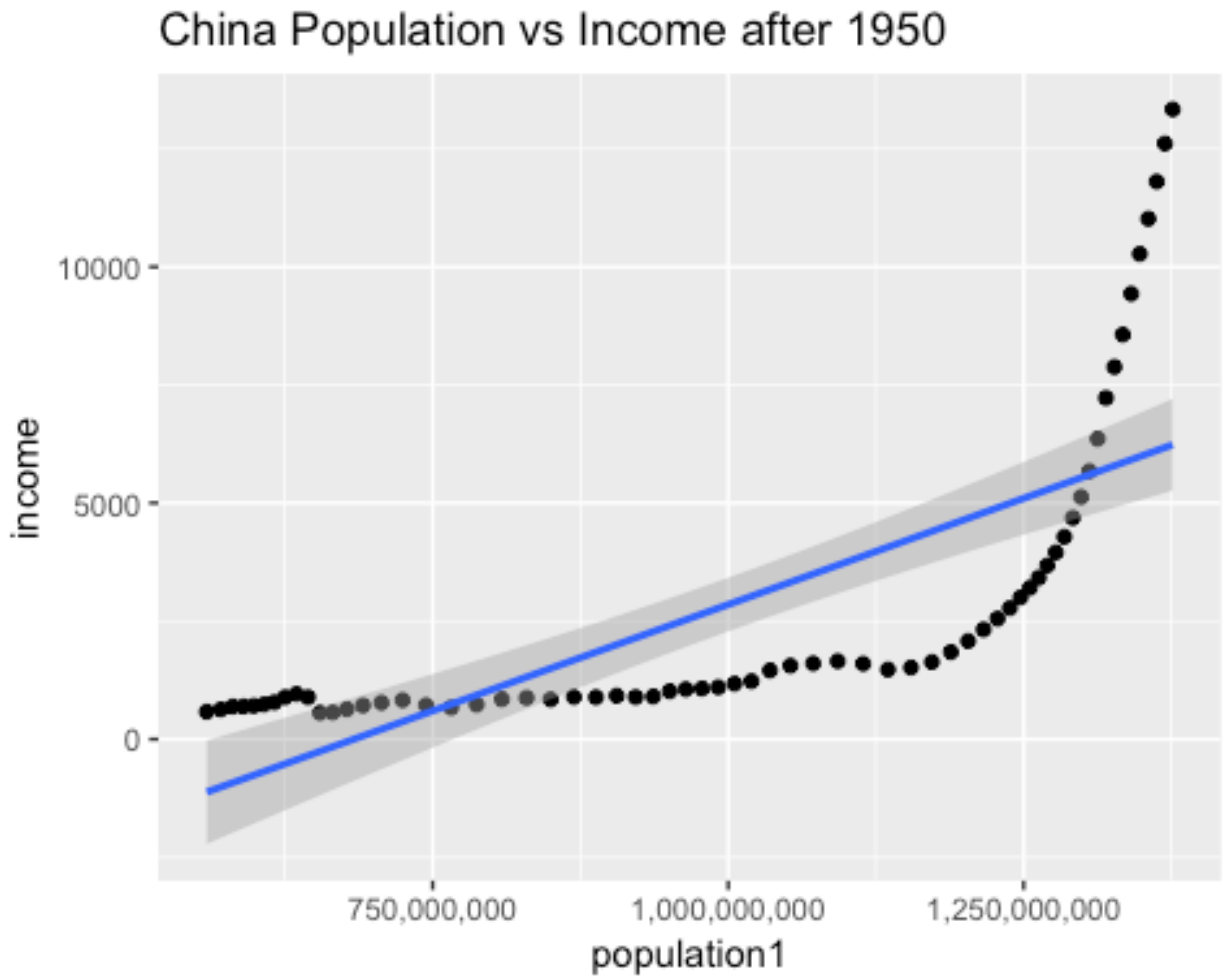
The population vs Income graph is interesting, a large amount of the population has an income between 1000 to 3000.

```
gapminder1 %>%filter(Country=='China') %>%##Filtering data for India
summarize('LifeExpected (Mean) in China'=mean(population1),
'Population (Standard Deviation) in China'=sd(population1))
##   LifeExpected (Mean) in China Population (Standard Deviation) in China
## 1                    886011895                                 340405516
#Filtering data for India after 1950
pop_chn_after_1950 <- population_china %>% filter(Year > '1950')

b <- ggplot(pop_chn_after_1950, aes(x = population1, y = life))
b + geom_point()+geom_smooth(method = "lm") + scale_x_continuous(labels
= scales::comma) + labs(title="China Population vs Life after 1950")
```



The population of China has a high number of age group between 50 to 60.

```
c <- ggplot(pop_chn_after_1950, aes(x = population1, y = income))
c + geom_point()+geom_smooth(method = "lm") + scale_x_continuous(labels
= scales::comma)  + labs(title="China Population vs Income after 1950")
```



We can see here the income rose for China and India after population crossed 1.1 billion. However, the rise in life expectancy reduced when the population crossed 600 million and flattened between 55 to 65 years.

Working with 2015 data

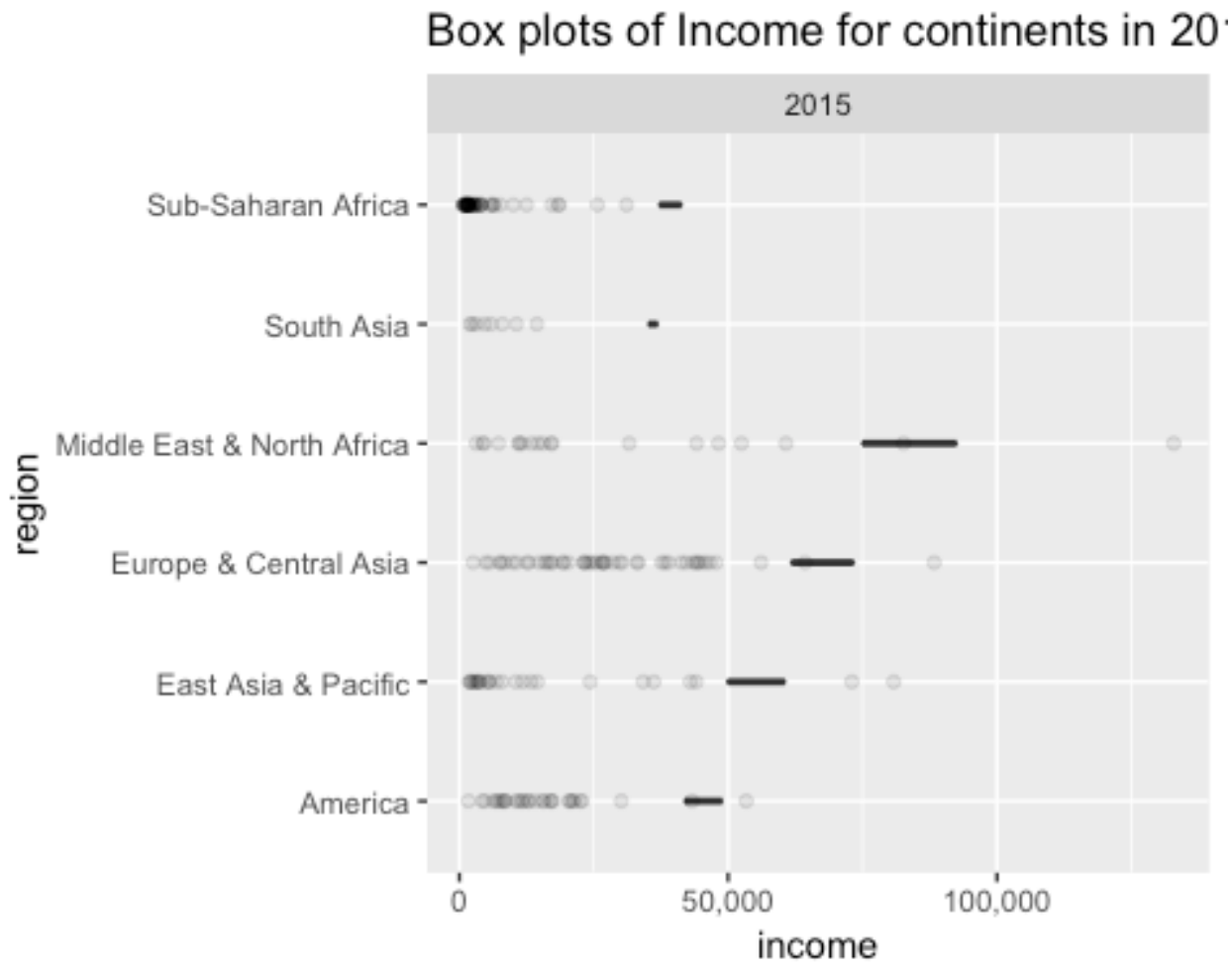
```
#Creating a dataset with 2015 data
gapminder_2015 <- gapminder %>%
 filter(Year==2015)
# Overview of 2015 data
summary(gapminder_2015)
##                Country         Year           life
##  Afghanistan        :  1   Min.   :2015   Min.   :48.50
##  Albania            :  1   1st Qu.:2015   1st Qu.:65.35
##  Algeria            :  1   Median :2015   Median :73.50
##  Andorra            :  1   Mean   :2015   Mean   :71.76
##  Angola             :  1   3rd Qu.:2015   3rd Qu.:77.97
##  Antigua and Barbuda:  1   Max.   :2015   Max.   :84.10
##  (Other)            :172
##          population      income                              region
##               :  1   Min.   :   624   America                   :31
##  1,376,048,943:  1   1st Qu.:  3715   East Asia & Pacific       :25
##  10,349,803   :  1   Median : 11360   Europe & Central Asia     :48
##  10,954,617   :  1   Mean   : 17717   Middle East & North Africa:19
##  100699395    :  1   3rd Qu.: 24290   South Asia                : 8
```

```
##  104460       :  1   Max.   :132877   Sub-Saharan Africa        :47
##  (Other)      :172
##   population1
##  Min.   :5.299e+04
##  1st Qu.:2.235e+06
##  Median :8.545e+06
##  Mean   :4.050e+07
##  3rd Qu.:2.851e+07
##  Max.   :1.376e+09
##  NA's   :1
```

Let us take a case for a single *year (2015)* and see at the income range and life expectancy comparison with respect to regions.

Income in 2015

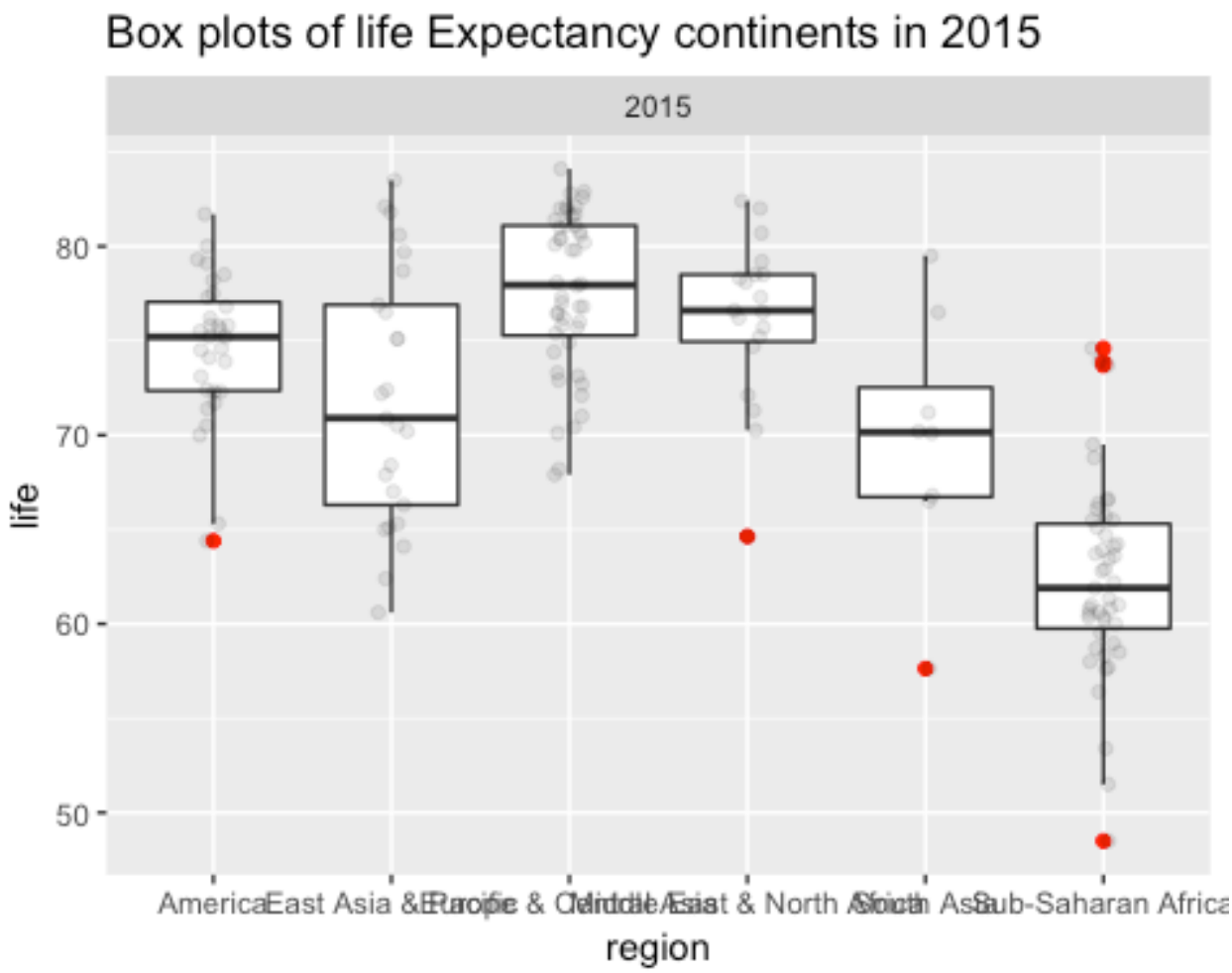
```
#Plotting 2015 data with income vs region
ggplot(gapminder_2015, aes(x = income, y = region)) + facet_wrap(~Year) +
geom_boxplot(outlier.colour = 'red') +
ggtitle('Box plots of Income for continents in 2015 across all countries') +
geom_jitter(position = position_jitter(width = 0.09, height = 0), alpha
= 1/10) +scale_x_continuous(labels = scales::comma)
```



Here we see that incomes for South Asia, Sub-Saharan Africa, and America is lower than 50000, while other regions go above this range and thus affecting the weighted mean and median.

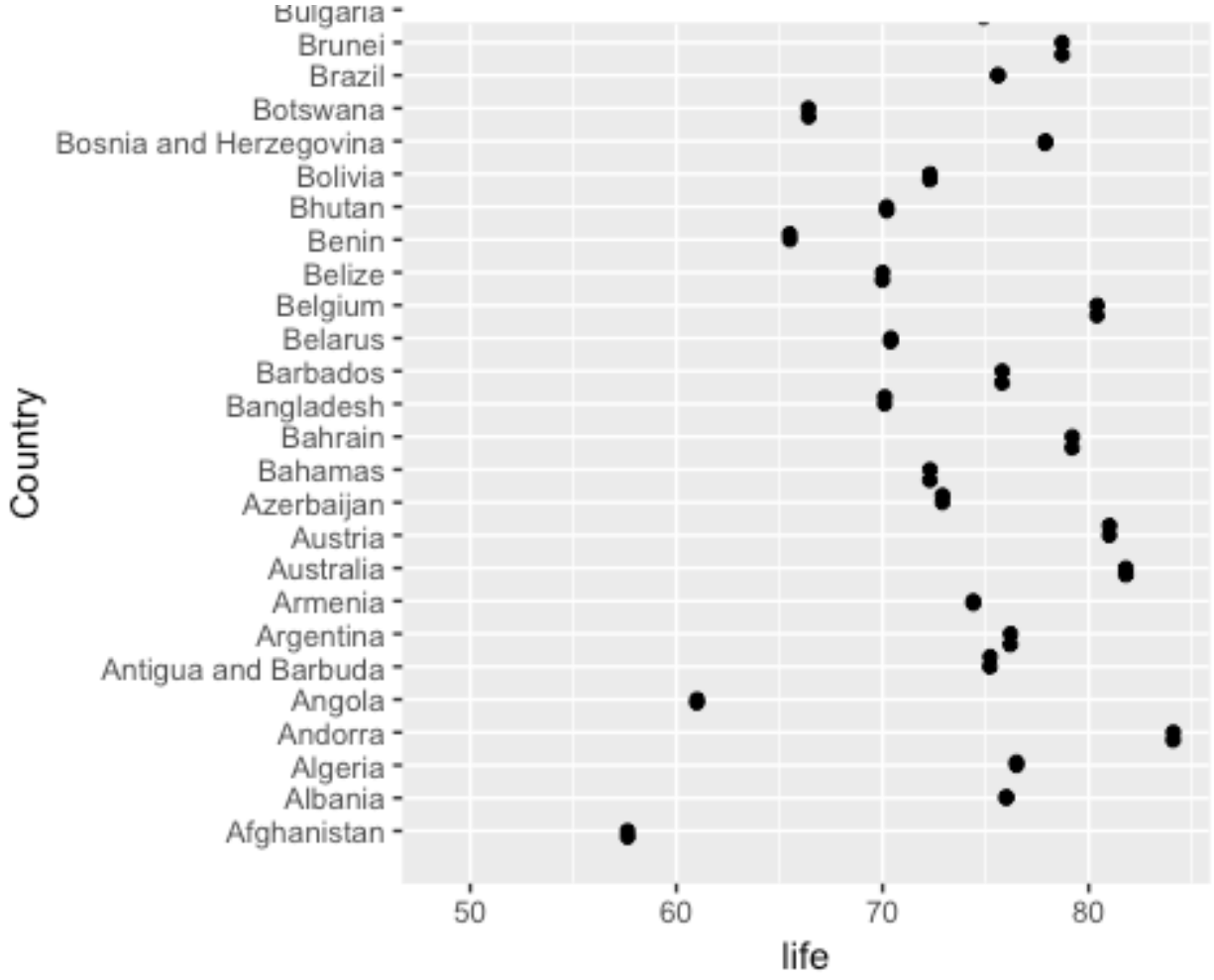
Life Expectancy in 2015

```
# Regions with life expectancy mean
ggplot(gapminder_2015, aes(x = region, y = life)) + facet_wrap(~Year) +
geom_boxplot(outlier.colour = 'red') + # extreme values marked red
ggtitle('Box plots of life Expectancy continents in 2015') +
geom_jitter(position = position_jitter(width = 0.09, height = 0), alpha = 1/10)
```



The box plot above describes the Life expectancy of continents in 2015, a large set between 65 to 75 in China, the smallest North Africa but at an older age group between 75 to 80.

```
#List of countries with life expectancy in 2015 arranged in descending order
life_gap_2015 <- gapminder_2015 %>%   group_by(Country) %>%   summarize(life) %>%   arrange(desc(lif
e))
ggplot(data= life_gap_2015, mapping
= aes(y=Country, x=life))+   geom_point()+   geom_jitter()+   coord_cartesian(ylim=c(0, 25))
```

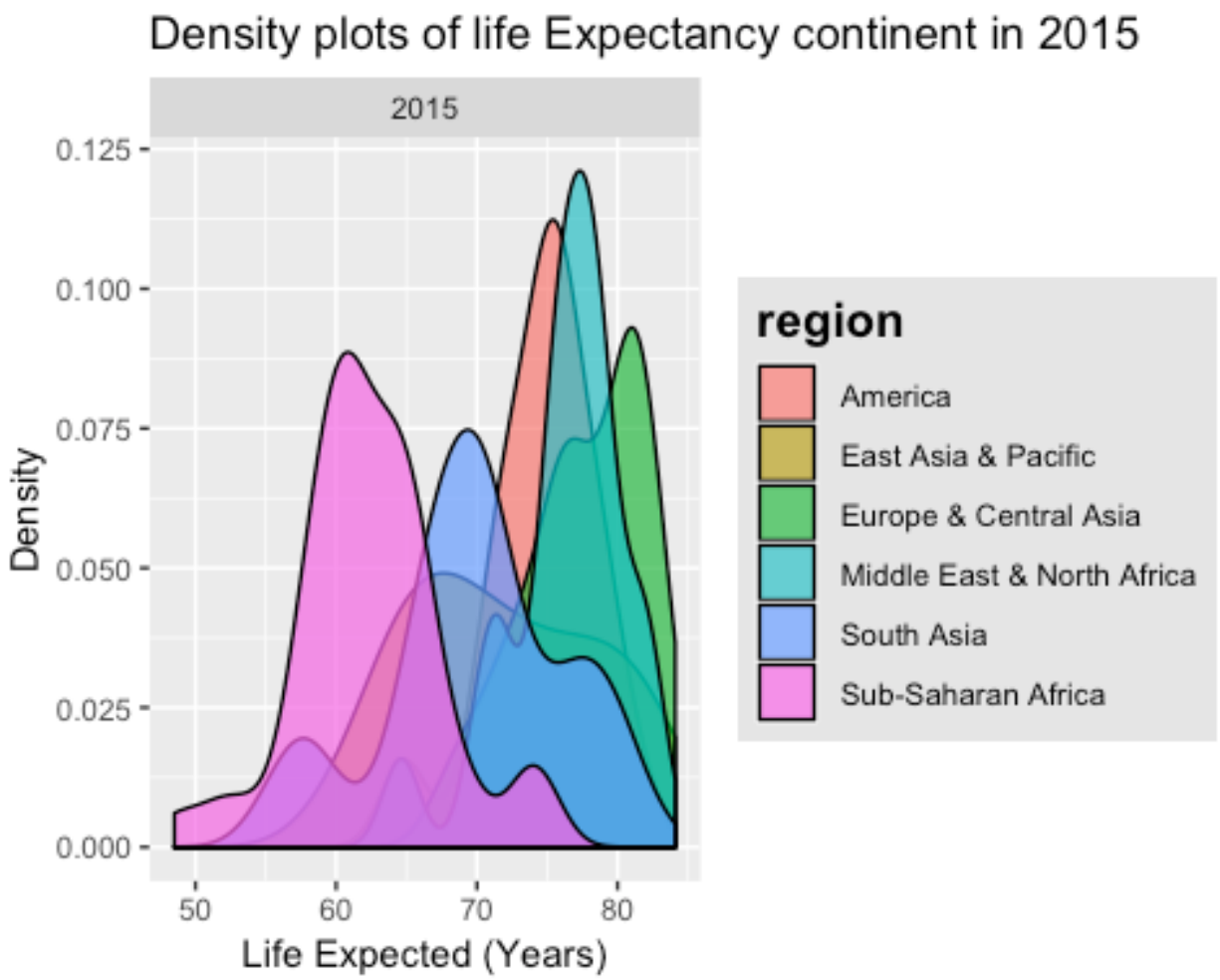


The plot above shows the age groups(LIFE) for countries.

```
gapminder_2015 %>% # For each continent in 2015
group_by(region) %>%
summarize('Standard Deviation'=sd(life),
'Inter Quartile Range'=IQR(life),
'Number'=n())
```

```
## # A tibble: 6 x 4
##   region                    `Standard Deviatio… `Inter Quartile Rang… Number
##   <fct>                                   <dbl>                 <dbl>  <int>
## 1 America                                  3.85                  4.7      31
## 2 East Asia & Pacific                      6.75                 10.6      25
## 3 Europe & Central Asia                    4.20                  5.82     48
## 4 Middle East & North Afr…                 4.31                  3.55     19
## 5 South Asia                               6.65                  5.8       8
## 6 Sub-Saharan Africa                       5.14                  5.55     47
```

```
gapminder_2015 %>%
ggplot(aes(x = life, fill = region)) + facet_wrap(~Year) + # aes = aesthetics
geom_density(alpha = 0.7) +
ggtitle('Density plots of life Expectancy continent in 2015') +
theme(legend.title = element_text(color = 'Black',size = 14, face = 'bold'),
legend.background = element_rect(fill = 'gray90', size = 0.5, linetype = 'dashed')) +
labs(x='Life Expected (Years)', y='Density')
```



Life Expectancy for America in 2015

Let us focus on a single region and in it a single country. Here, the example considered is the region of **America** and the country sample is **United States**.

Calucating the standard deviation for America in 2015:

```
gapminder_2015 %>% #compute stats
filter(region=='America') %>%
summarize('LifeExpectancy (Mean) in America for 2015'=mean(life),
'LifeExpectancy (Standard Deviation) in America for 2015'=sd(life))
##   LifeExpectancy (Mean) in America for 2015
## 1                                  74.64516
##   LifeExpectancy (Standard Deviation) in America for 2015
## 1                                                3.853729
```

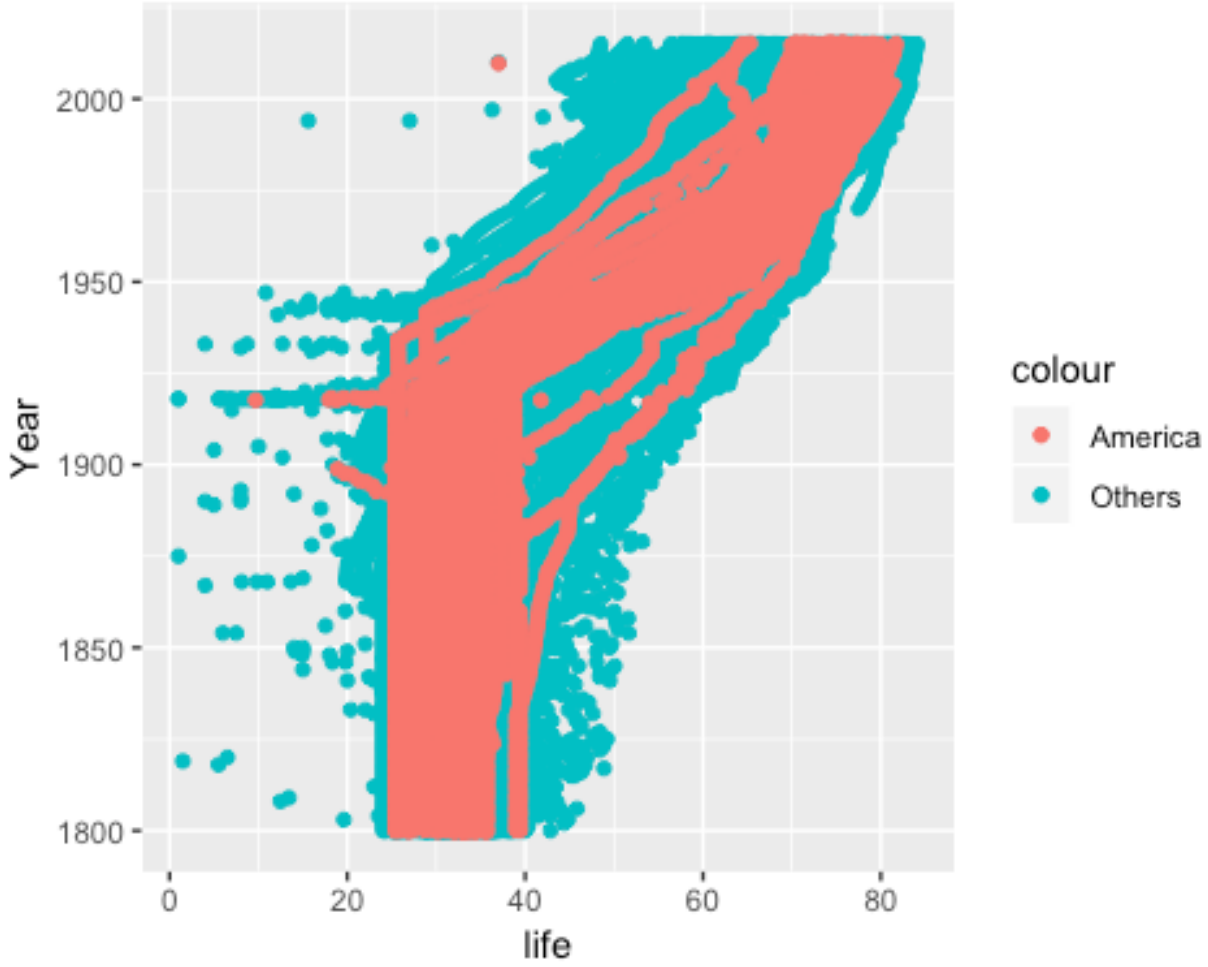
America and United States in 2015

```
# Creating subset of America region
life_America <- gapminder %>% filter(region=='America')
# Creating subset of United States country
life_USA <- gapminder %>%   filter(Country=='United States')
```

Plotting Life Expectancy in 2015:

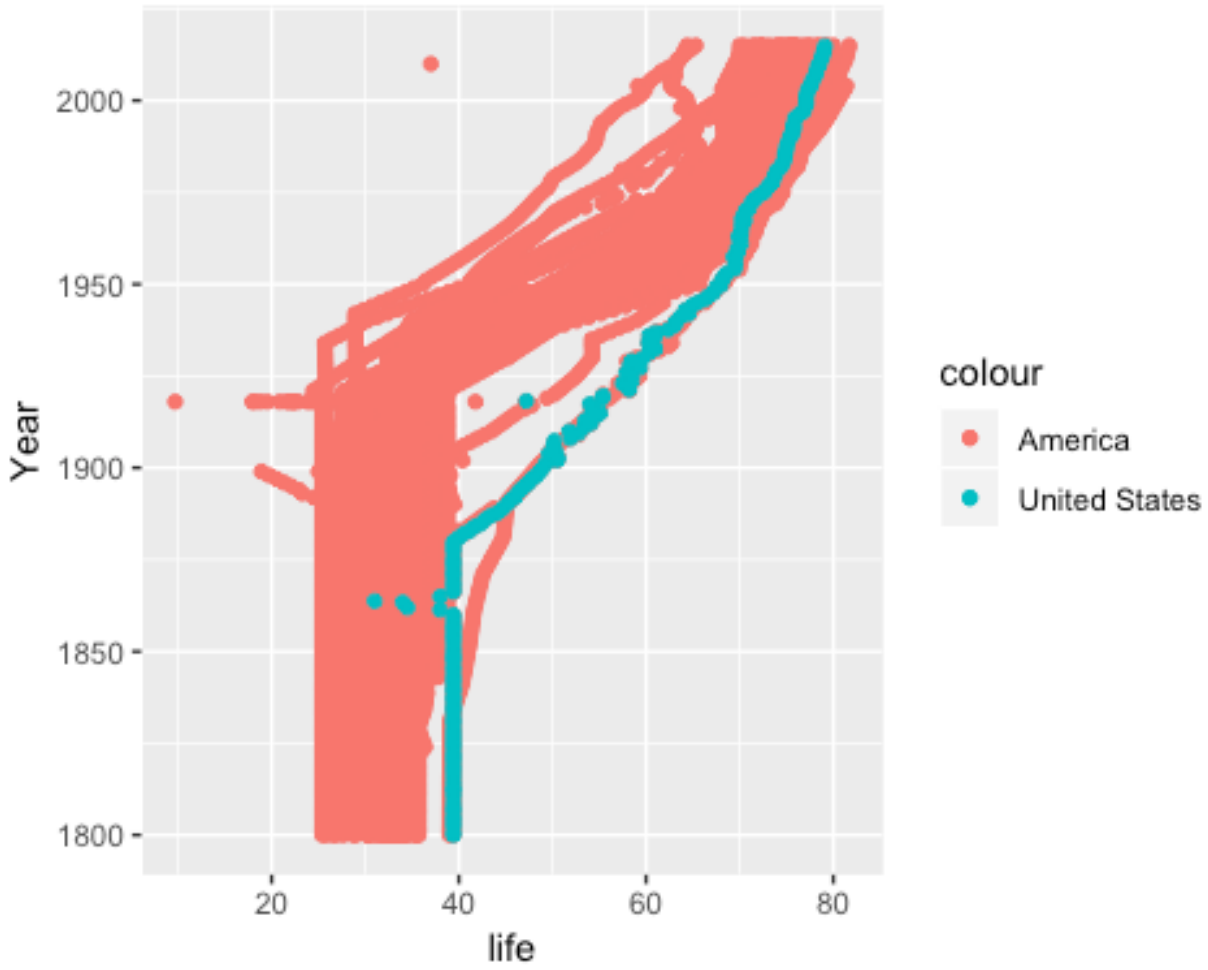
America region vs other region in world
United States country vs other countries in America

```
ggplot(data= life_America, mapping = aes(y=Year, x=life, color="America")) + geom_point(data
= gapminder, aes(color="Others")) + geom_jitter()
```



The graph shows that the Life Expectancy is below average int he early years for America, but since 1950s, America's life expectancy has improved and to be above average than most of the other regions.

```
ggplot(data= life_USA, mapping = aes(y=Year, x=life, color="United States")) + geom_point(data
= life_America, aes(color="America")) + geom_jitter()
```



While comparing United States to America, the Life expectancy of United States is higher than most of other countries in the same region since the beginning.

Summary

Income for some of the regions are higher than compared to other regions. In 2015, average Income Middle East & North Africa has been the highest compared to South Asia where it recorded lowest average income. **Income rises when the population remains lower.**

The average income is 12397 across all region, but if the regions are considered, then the income reduces to 3900, meaning that income in some of the region is much lower than that of other regions.

Life Expectancy We find that life expectancy in the given dataset is higher in the range of 25-35 years. The mean of Life Expectancy in 2015 for Sub-Saharan Africa region is lower than all other regions, while Europe & Central Asia is highest. **There is a relationship between Life Expectancy and income.**

As the life expectancy grows above 60, the income levels rise higher.

When magnified the analysis to American region, the life Expectancy is nearly 75%. Though the average life expectancy of America improves from below average to above average from 1800 to 2015, the life expectancy of United States has been highest than most of the American countries from 1800 to 2015.

Population We see that India and China are higher in population than other countries. **There is a exponential growth in these countries after 1950.** We also saw that population causes a flattening effect on life expectancy (over 600 million) and also extreme population (over 1 billion) witnesses an increased growth in income.