Exploratory Data Analysis

Exploratory Data Analysis

This is a document for exploring the global indicator dataset that was extracted from the combination of numerous datasets

Loading packages and dataset

The tidyverse package was loaded below.

```
## The tidyverse package was loaded using the command below
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.0 --

## v ggplot2 3.3.3     v purrr   0.3.4
## v tibble  3.1.0     v dplyr   1.0.5
## v tidyr   1.1.3     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.1

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

The World_data dataset is loaded below

```
df_world <- read.csv("~/Global-Analysis/Great_data.csv")
```

Data Comprehension

The datasets was reviewed below to improve our understanding of the dataset

```
## Checking out the dataset
head(df_world)
```

```
##       Country Year Life.Expectancy Income Population    Continent
## 1 Afghanistan 1995            53.3   1030   18100000         Asia
## 2     Albania 1995            74.6   4130    3110000       Europe
## 3     Algeria 1995            72.9   9340   28800000       Africa
## 4      Angola 1995            49.5   3410   13900000       Africa
## 5   Argentina 1995            73.3  14000   34800000 The Americas
## 6     Armenia 1995            69.9   2170    3220000         Asia
```

```
##   Economic.Freedom.Index Property.Rights Government.Integrity
## 1                    0.0               0                    0
## 2                   49.7              50                   10
## 3                   55.7              50                   50
## 4                   27.4              30                   30
## 5                   68.0              70                   50
## 6                    0.0               0                    0
##   Judicial.Effectiveness Tax.Burden Government.Spending Fiscal.Health
## 1                      0        0.0                 0.0             0
## 2                      0       81.7                34.3             0
## 3                      0       48.8                69.5             0
## 4                      0       61.6                 0.0             0
## 5                      0       80.7                86.6             0
## 6                      0        0.0                 0.0             0
##   Business.Freedom Labor.Freedom Monetary.Freedom Trade.Freedom
## 1                0             0              0.0           0.0
## 2               70             0             22.1          59.0
## 3               70             0             59.2          54.2
## 4               40             0              0.0          25.0
## 5               85             0             61.1          58.4
## 6                0             0              0.0           0.0
##   Investment.Freedom Financial.Freedom Income.Index Expected.years.of.Schooling
## 1                  0                 0        0.393                         4.2
## 2                 70                50        0.584                        10.2
## 3                 50                50        0.654                         9.8
## 4                 30                30        0.533                         3.9
## 5                 70                50        0.777                        13.3
## 6                  0                 0        0.519                        10.2
##   Education.Index Human.Development.Index Free.Market.Class
## 1           0.179                   0.331         Repressed
## 2           0.550                   0.637         Repressed
## 3           0.431                   0.595     Mostly Unfree
## 4           0.000                   0.000         Repressed
## 5           0.648                   0.741   Moderately Free
## 6           0.631                   0.627         Repressed
```

```
colnames(df_world)
```

```
##  [1] "Country"                     "Year"
##  [3] "Life.Expectancy"             "Income"
##  [5] "Population"                  "Continent"
##  [7] "Economic.Freedom.Index"      "Property.Rights"
##  [9] "Government.Integrity"        "Judicial.Effectiveness"
## [11] "Tax.Burden"                  "Government.Spending"
## [13] "Fiscal.Health"               "Business.Freedom"
## [15] "Labor.Freedom"               "Monetary.Freedom"
## [17] "Trade.Freedom"               "Investment.Freedom"
## [19] "Financial.Freedom"           "Income.Index"
## [21] "Expected.years.of.Schooling" "Education.Index"
## [23] "Human.Development.Index"     "Free.Market.Class"
```

Structure of the dataset

```r
## Looking into the structure of the dataset
str(df_world)
```

```
## 'data.frame':    4181 obs. of  24 variables:
##  $ Country                    : Factor w/ 168 levels "Afghanistan",..: 1 2 3 4 5 6 7 8 9 10 ...
##  $ Year                       : int  1995 1995 1995 1995 1995 1995 1995 1995 1995 1995 ...
##  $ Life.Expectancy            : num  53.3 74.6 72.9 49.5 73.3 69.9 78.2 76.8 65 71 ...
##  $ Income                     : int  1030 4130 9340 3410 14000 2170 30400 33800 3430 42900 ...
##  $ Population                 : int  18100000 3110000 28800000 13900000 34800000 3220000 18000000 79
##  $ Continent                  : Factor w/ 6 levels "Africa","Asia",..: 2 3 1 1 6 2 5 3 2 4 ...
##  $ Economic.Freedom.Index     : num  0 49.7 55.7 27.4 68 0 74.1 70 0 76.2 ...
##  $ Property.Rights            : num  0 50 50 30 70 0 90 90 0 60 ...
##  $ Government.Integrity       : num  0 10 50 30 50 0 70 90 0 70 ...
##  $ Judicial.Effectiveness     : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Tax.Burden                 : num  0 81.7 48.8 61.6 80.7 0 59.6 46.3 0 99.4 ...
##  $ Government.Spending        : num  0 34.3 69.5 0 86.6 0 53.9 9.6 0 71.7 ...
##  $ Fiscal.Health              : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Business.Freedom           : num  0 70 70 40 85 0 70 70 0 100 ...
##  $ Labor.Freedom              : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ Monetary.Freedom           : num  0 22.1 59.2 0 61.1 0 86.7 82.9 0 86.7 ...
##  $ Trade.Freedom              : num  0 59 54.2 25 58.4 0 77 81 0 78.4 ...
##  $ Investment.Freedom         : int  0 70 50 30 70 0 70 70 0 50 ...
##  $ Financial.Freedom          : int  0 50 50 30 50 0 90 90 0 70 ...
##  $ Income.Index               : num  0.393 0.584 0.654 0.533 0.777 0.519 0.872 0.907 0.513 0.926 ...
##  $ Expected.years.of.Schooling: num  4.2 10.2 9.8 3.9 13.3 10.2 18.8 14.9 10 13.7 ...
##  $ Education.Index            : num  0.179 0.55 0.431 0 0.648 0.631 0.894 0.709 0.618 0.619 ...
##  $ Human.Development.Index    : num  0.331 0.637 0.595 0 0.741 0.627 0.888 0.825 0.604 0.778 ...
##  $ Free.Market.Class          : Factor w/ 5 levels "Free","Moderately Free",..: 5 5 4 5 2 5 3 3 5 3
```

Renaming the columns

```r
## The columns in the dataset had to be renamed in order to make
## it easy to conduct certain functions
df_world <- df_world %>%
  rename(c(Economic_Freedom_Index = Economic.Freedom.Index,
           Life_Expectancy = Life.Expectancy,
           Government_Integrity = Government.Integrity,
           Government_Spending = Government.Spending,
           Property_Rights = Property.Rights,
           Fiscal_Health = Fiscal.Health,
           Business_Freedom = Business.Freedom,
           Monetary_Freedom = Monetary.Freedom,
           Trade_Freedom = Trade.Freedom,
           Investment_Freedom = Investment.Freedom,
           Financial_Freedom = Financial.Freedom,
           Income_Index = Income.Index,
           Tax_Burden = Tax.Burden,
           Labor_Freedom = Labor.Freedom,
           Expected_schooling = Expected.years.of.Schooling,
           Education_Index = Education.Index,
           Human_Development_Index = Human.Development.Index,
           Judicial_Effectiveness = Judicial.Effectiveness,
```

```
            Free_Market_Class = Free.Market.Class
            ))
```

Filtering out information

```
## Checking out the Business Freedom score over the years
df_nigeria <- df_world %>%
  filter(Country == 'Nigeria') %>%
  select(Business_Freedom, Year)
df_nigeria
```

```
##    Business_Freedom Year
## 1              55.0 1995
## 2              55.0 1996
## 3              55.0 1997
## 4              55.0 1998
## 5              55.0 1999
## 6              55.0 2000
## 7              55.0 2001
## 8              55.0 2002
## 9              55.0 2003
## 10             55.0 2004
## 11             55.0 2005
## 12             50.0 2006
## 13             58.6 2007
## 14             52.9 2008
## 15             55.1 2009
## 16             53.2 2010
## 17             51.6 2011
## 18             55.6 2012
## 19             55.7 2013
## 20             48.0 2014
## 21             48.3 2015
## 22             48.7 2016
## 23             48.9 2017
## 24             49.3 2018
## 25             51.2 2019
```

Charts

Scatter plot function

Creating scatter plot functions to explore the relationship between the indicators

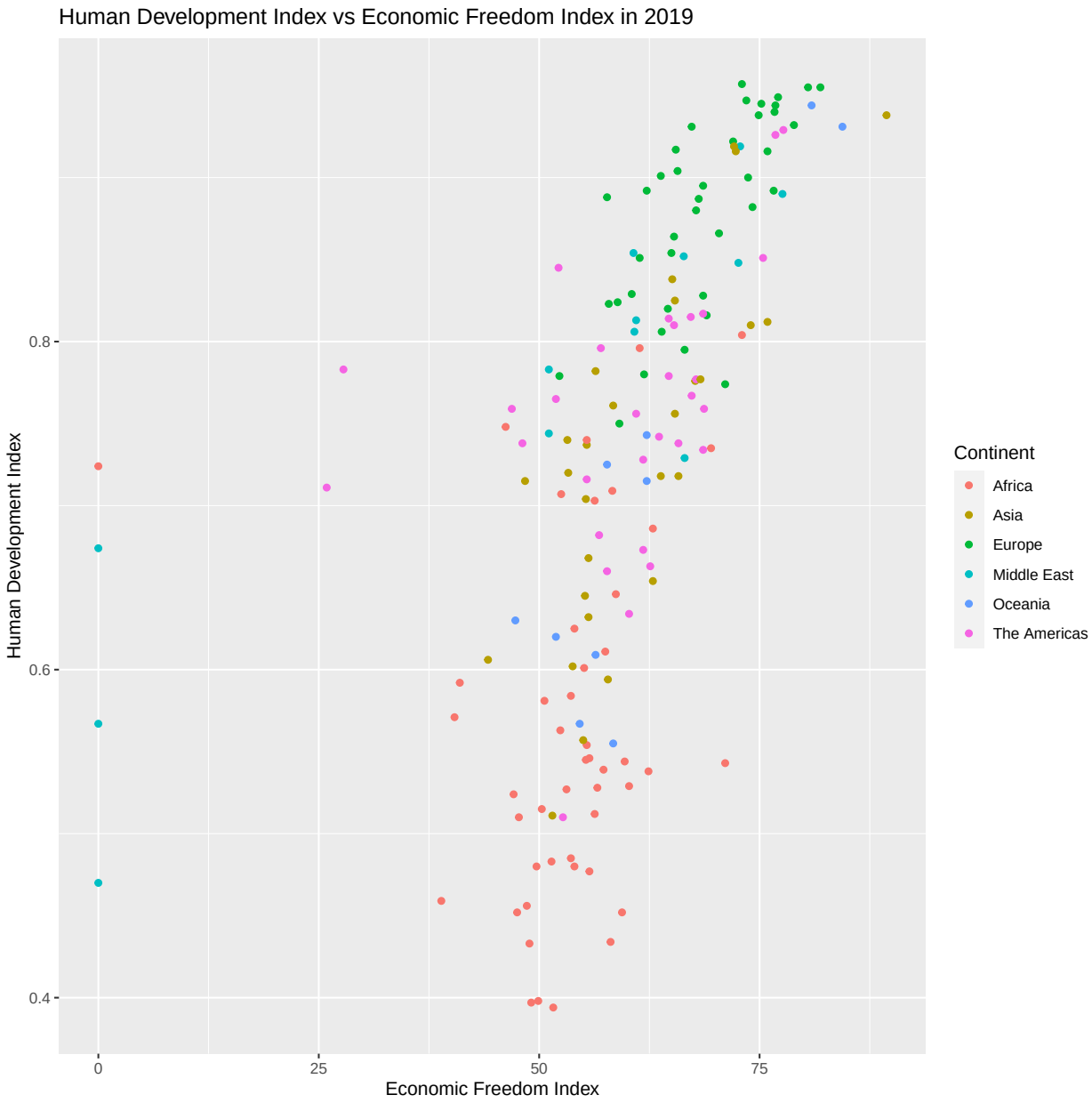
```
## Human Development Index vs Economic Freedom Index
scatter1 <- function(df, year) {
  df %>%
    filter(Year == year) %>%
    ggplot() +
    geom_point(aes(x = Economic_Freedom_Index,
                   y = Human_Development_Index,
                  color = Continent), na.rm = TRUE) +
```

```
    labs(title = sprintf("Human Development Index vs Economic Freedom Index in %d", year),
         x = "Economic Freedom Index",
         y = "Human Development Index")

}
## Education Index vs Economic Freedom Index
scatter2 <- function(df, year) {
  df %>%
    filter(Year == year) %>%
    ggplot() +
    geom_point(aes(x = Economic_Freedom_Index,
                   y = Education_Index,
                   color = Continent), na.rm = TRUE) +
    labs(title = sprintf("Education Index vs Economic Freedom Index in %d", year),
         x = "Economic Freedom Index",
         y = "Education Index")
}
## Life Expectancy vs Economic Freedom Index
scatter3 <- function(df, year) {
  df %>%
    filter(Year == year) %>%
    ggplot() +
    geom_point(aes(x = Economic_Freedom_Index,
                     y = Life_Expectancy,
                   color = Continent), na.rm = TRUE) +
    labs(title = sprintf("Life Expectancy vs Economic Freedom Index in %d", year),
         x = "Economic Freedom Index",
         y = "Life Expectancy")
}
## Government Integrity vs Government Spending
scatter4 <- function(df, year) {
  df %>%
    filter(Year == year) %>%
    ggplot() +
    geom_point(aes(x = Government_Spending,
                     y = Government_Integrity,
                   color = Continent), na.rm = TRUE) +
    labs(title = sprintf("Government Integrity vs Government Spending in %d", year),
         x = "Government Spending",
         y = "Government Integrity")
}
```

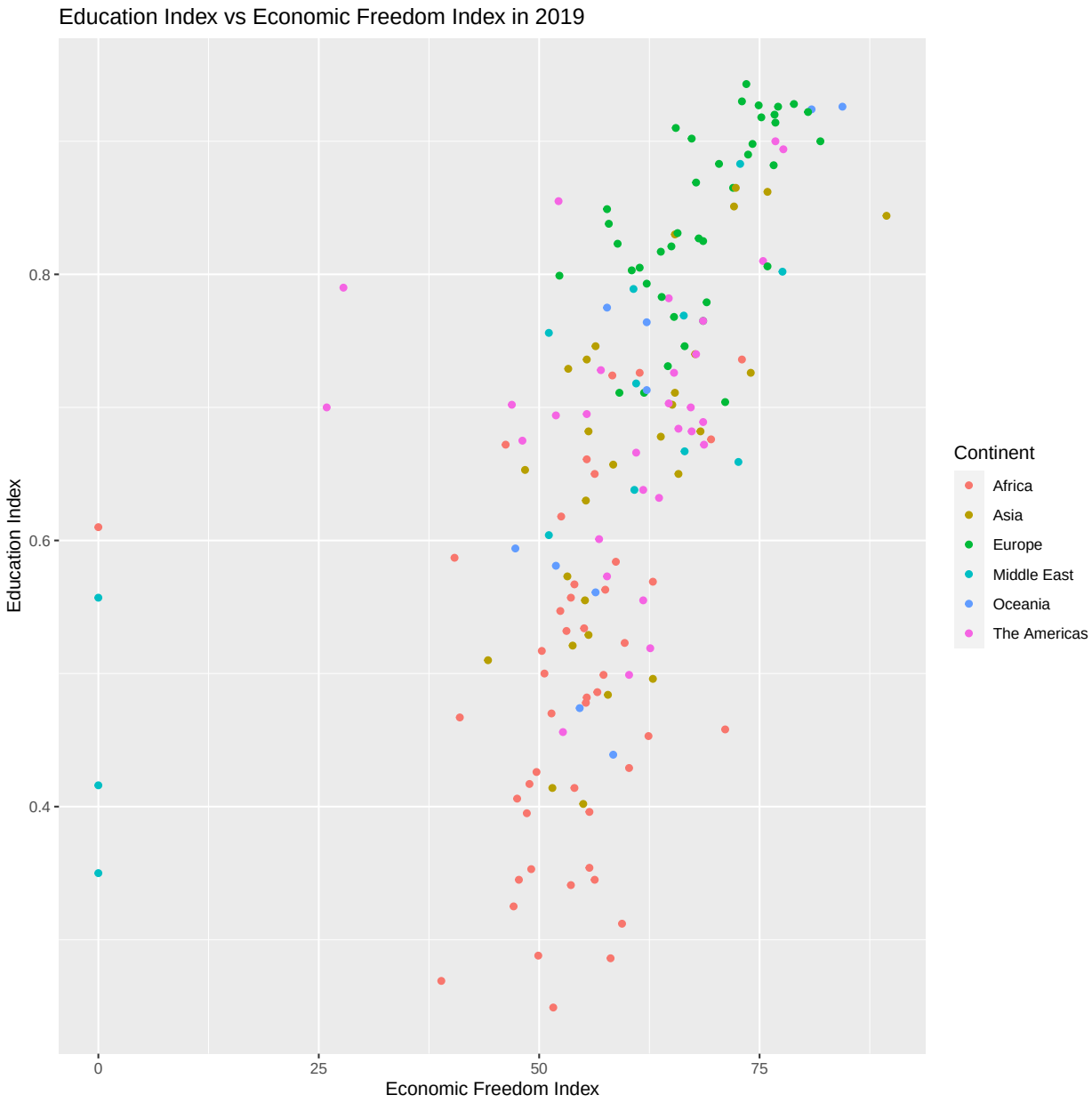
Human Development Index vs Economic Freedom Index

```
scatter1(df_world, 2019)
```



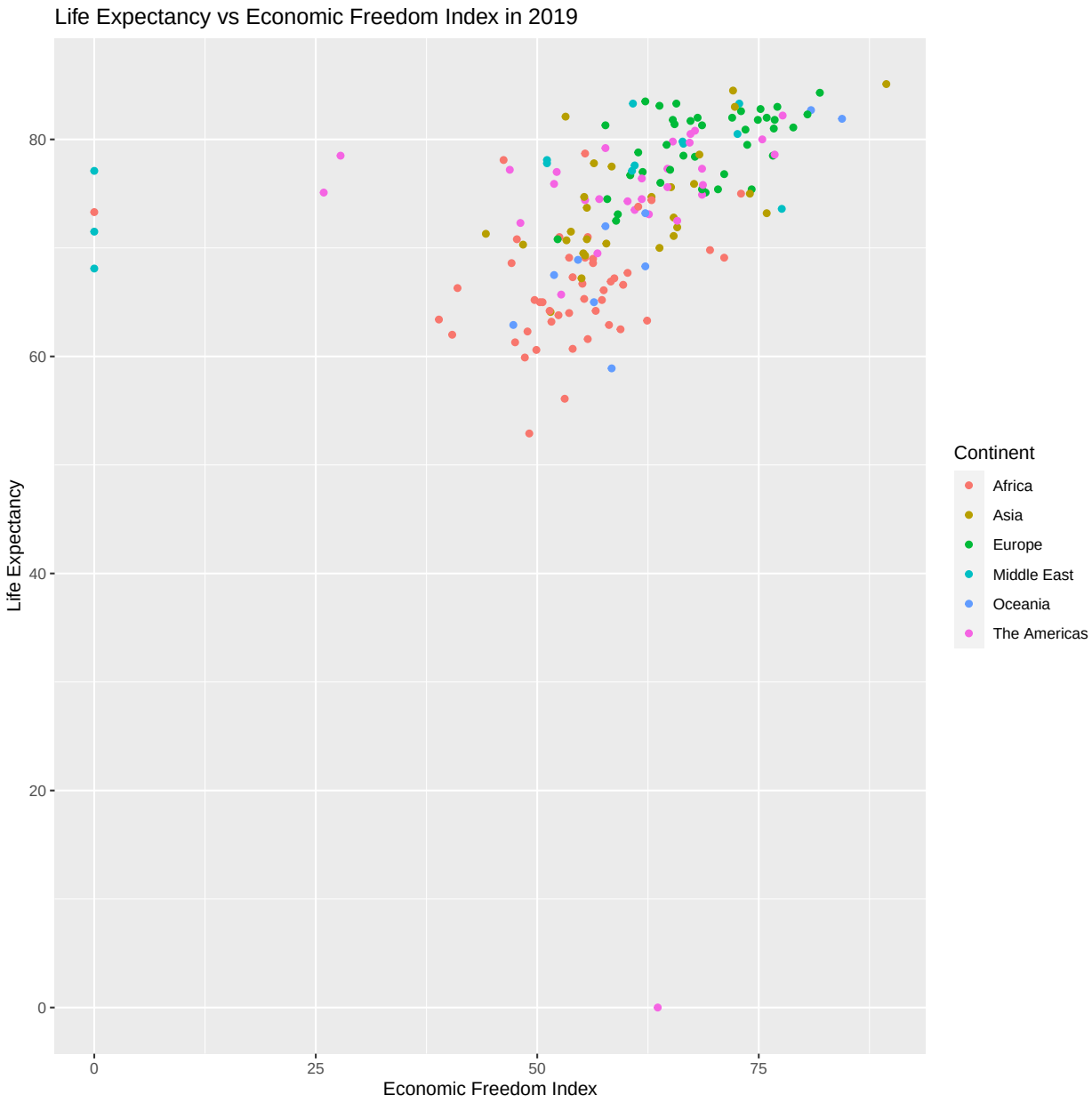
Education Index vs Economic Freedom Index

```
scatter2(df_world, 2019)
```



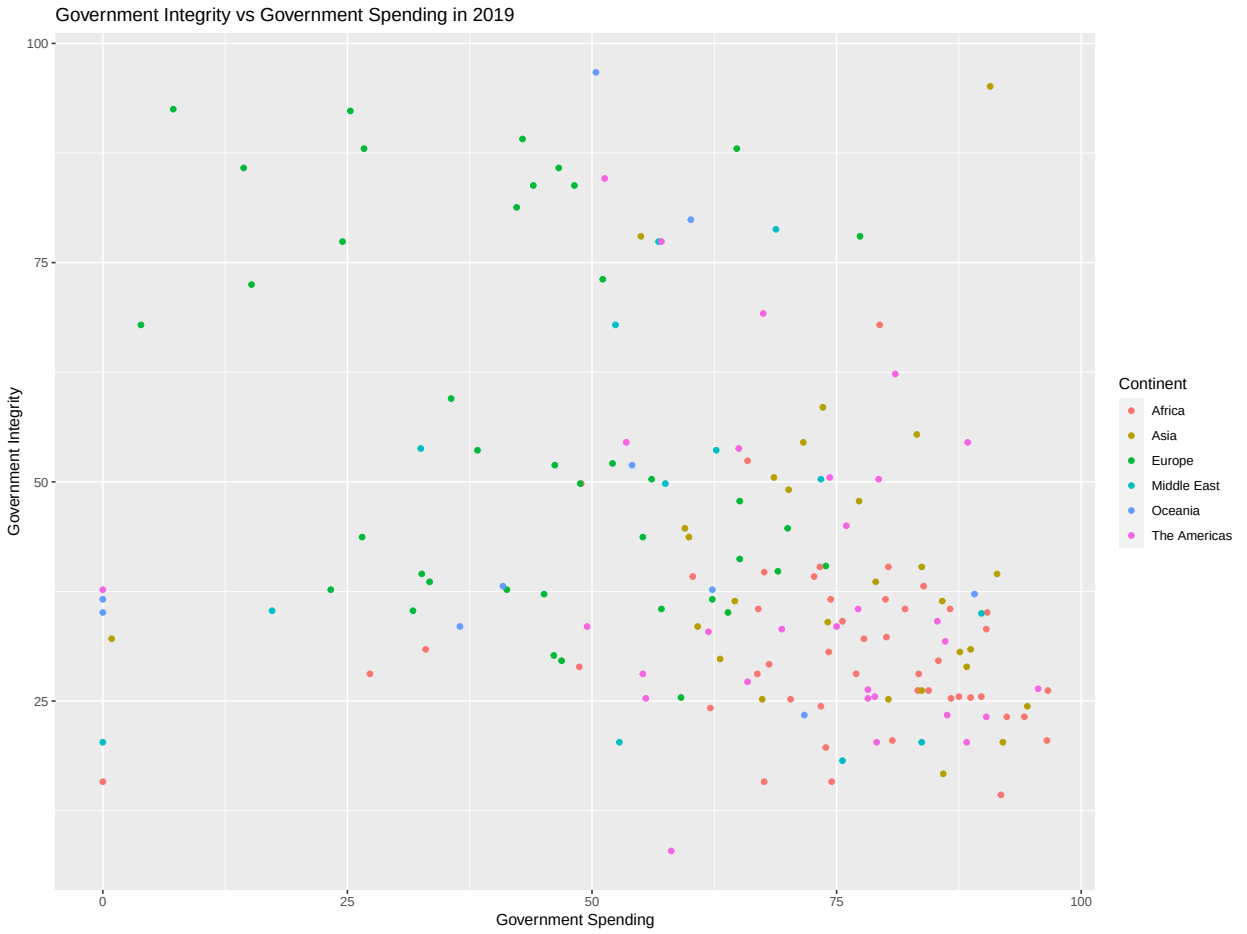
Life Expectancy vs Economic Freedom Index

```
scatter3(df_world, 2019)
```



Government Integrity vs Government Spending

```
scatter4(df_world, 2019)
```

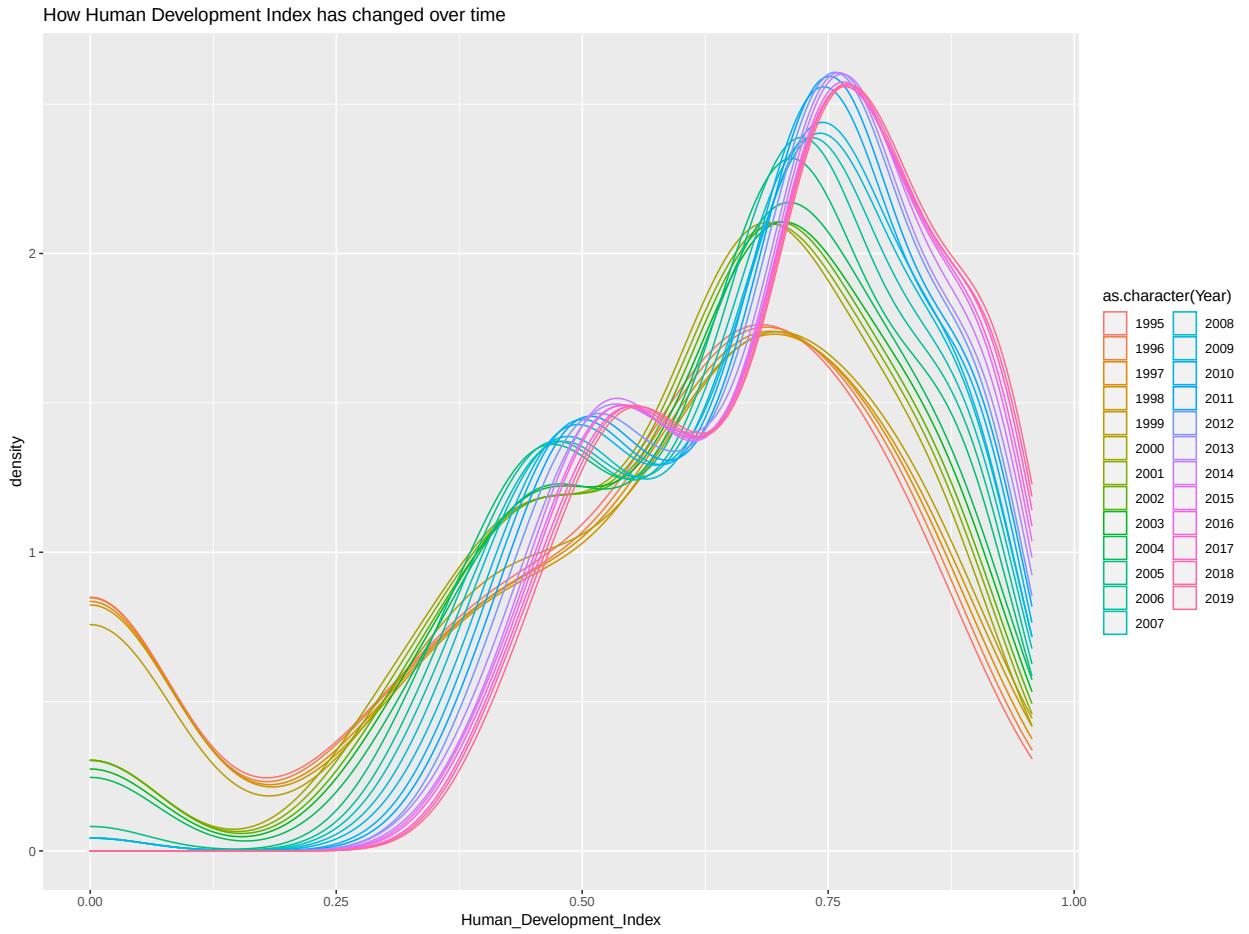


Kernel Density Estimation Plot

Exploring how countries' indicators have been distributed over time

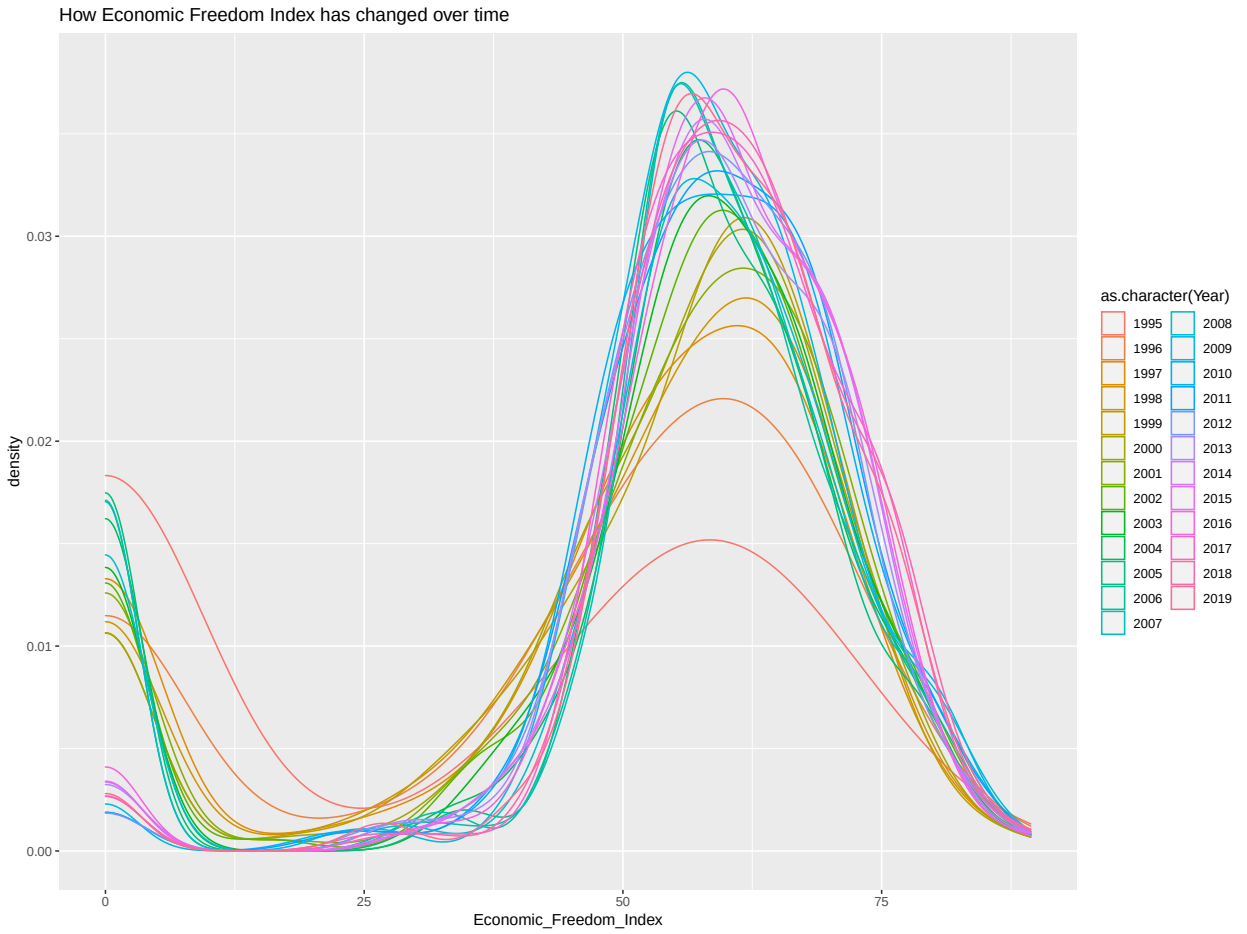
Human Development Index

```
ggplot(df_world) +
  geom_density(aes(x = Human_Development_Index,
                   color = as.character(Year)),
               show.legend = NA) +
  labs(title = "How Human Development Index has changed over time")
```



Economic Freedom Index

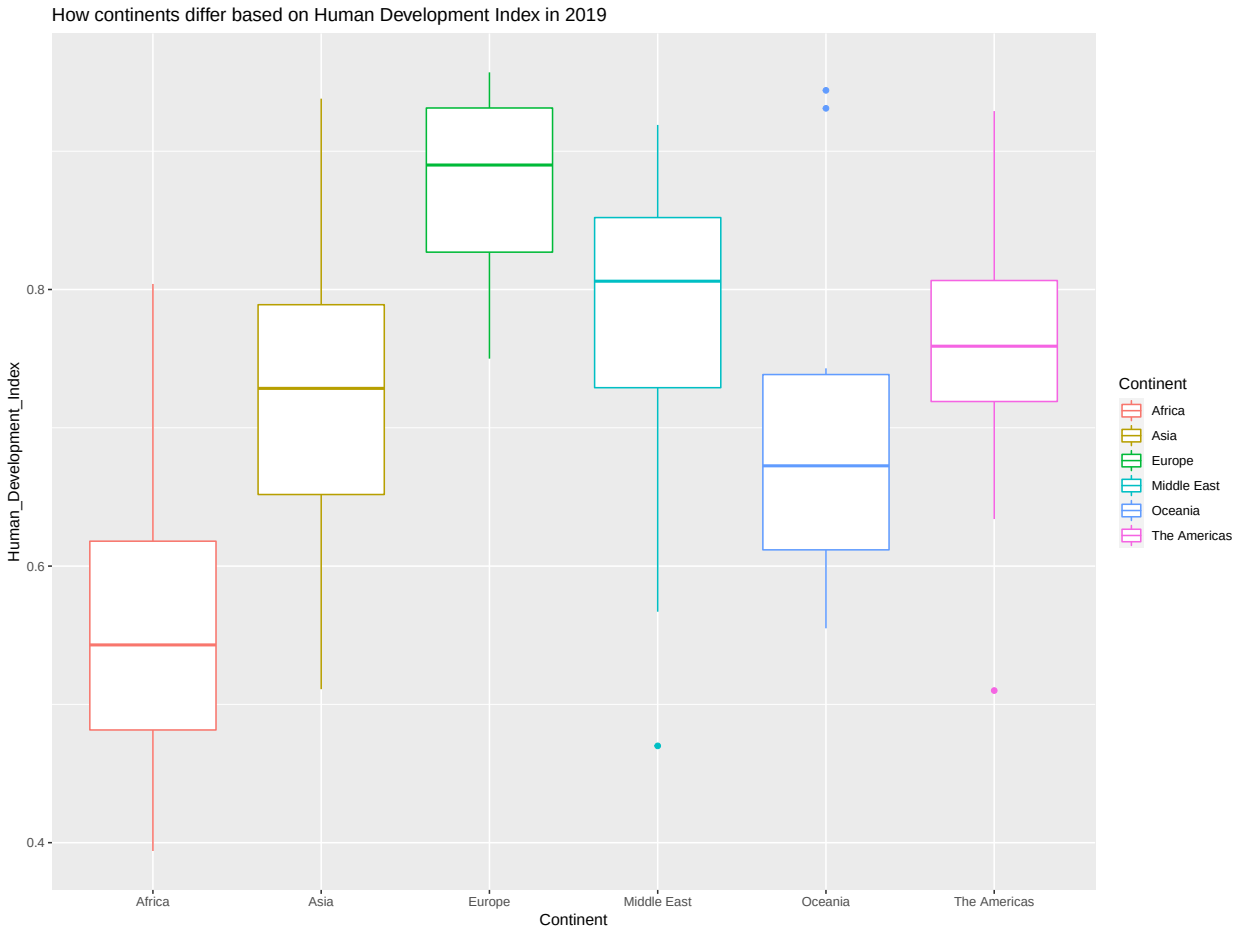
```
ggplot(df_world) +
  geom_density(aes(x = Economic_Freedom_Index,
                   color = as.character(Year)),
               show.legend = NA) +
  labs(title = "How Economic Freedom Index has changed over time")
```



Box Plot

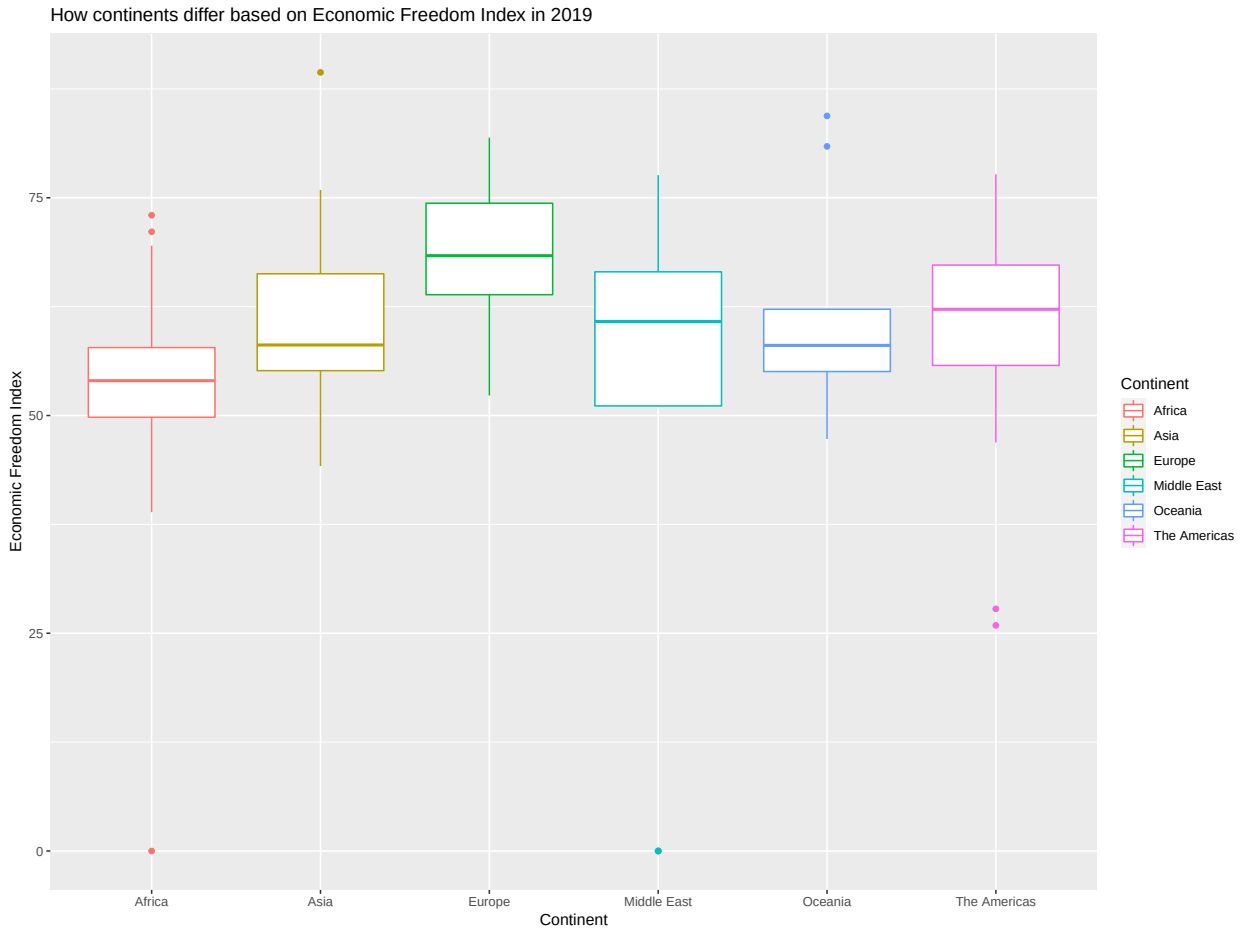
Continent Disparities for Human Development Index in 2019

```
df_world %>%
  filter(Year == 2019) %>%
  ggplot() +
  geom_boxplot(aes(x = Continent, y = Human_Development_Index,
                   color = Continent)) +
  labs(title = "How continents differ based on Human Development Index in 2019")
```



Continent Disparities for Economic Freedom Index in 2019

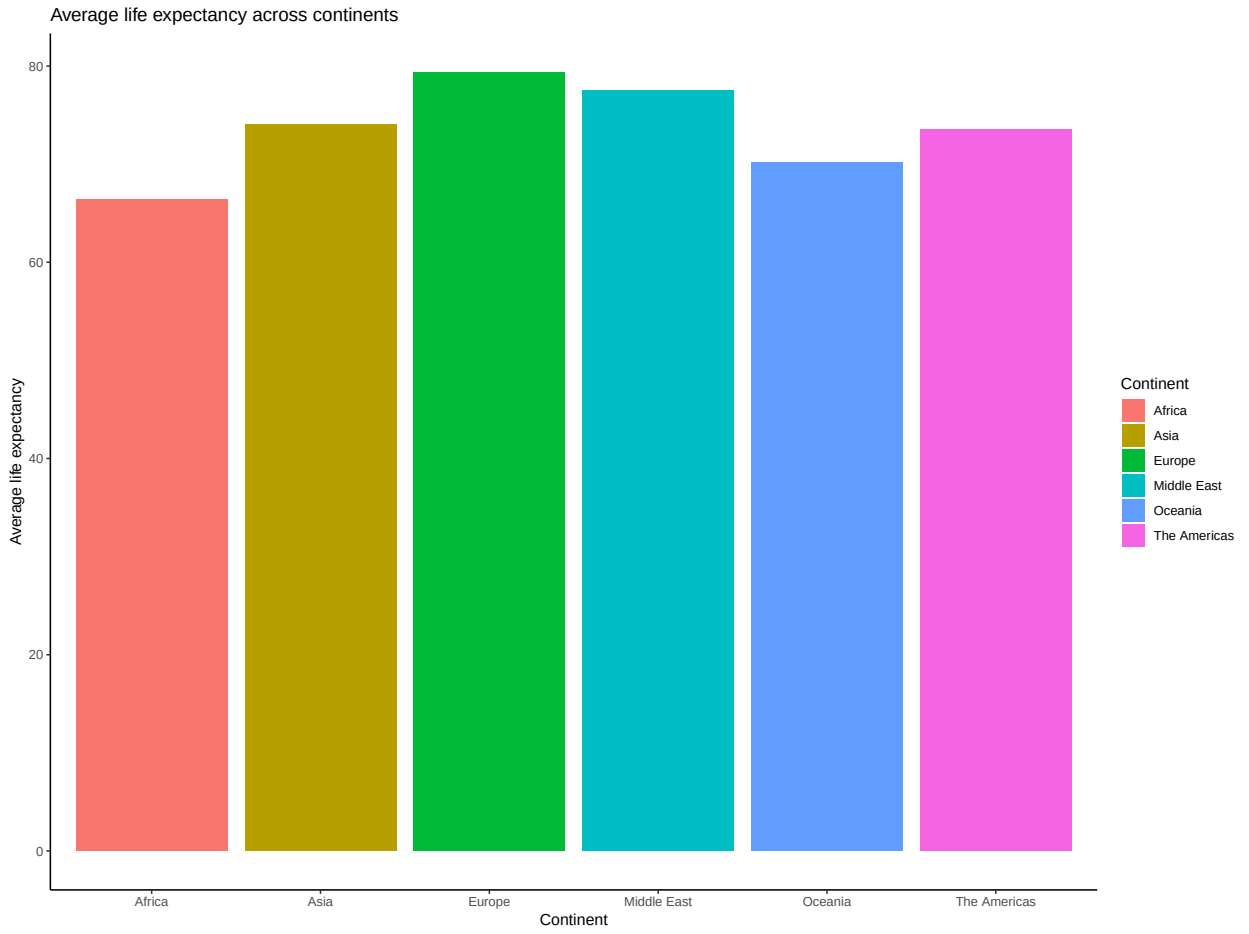
```
df_world %>%
  filter(Year == 2019) %>%
  ggplot() +
  geom_boxplot(aes(x = Continent, y = Economic_Freedom_Index,
                   color = Continent)) +
  labs(title = "How continents differ based on Economic Freedom Index in 2019",
       y = "Economic Freedom Index")
```



Bar Chart

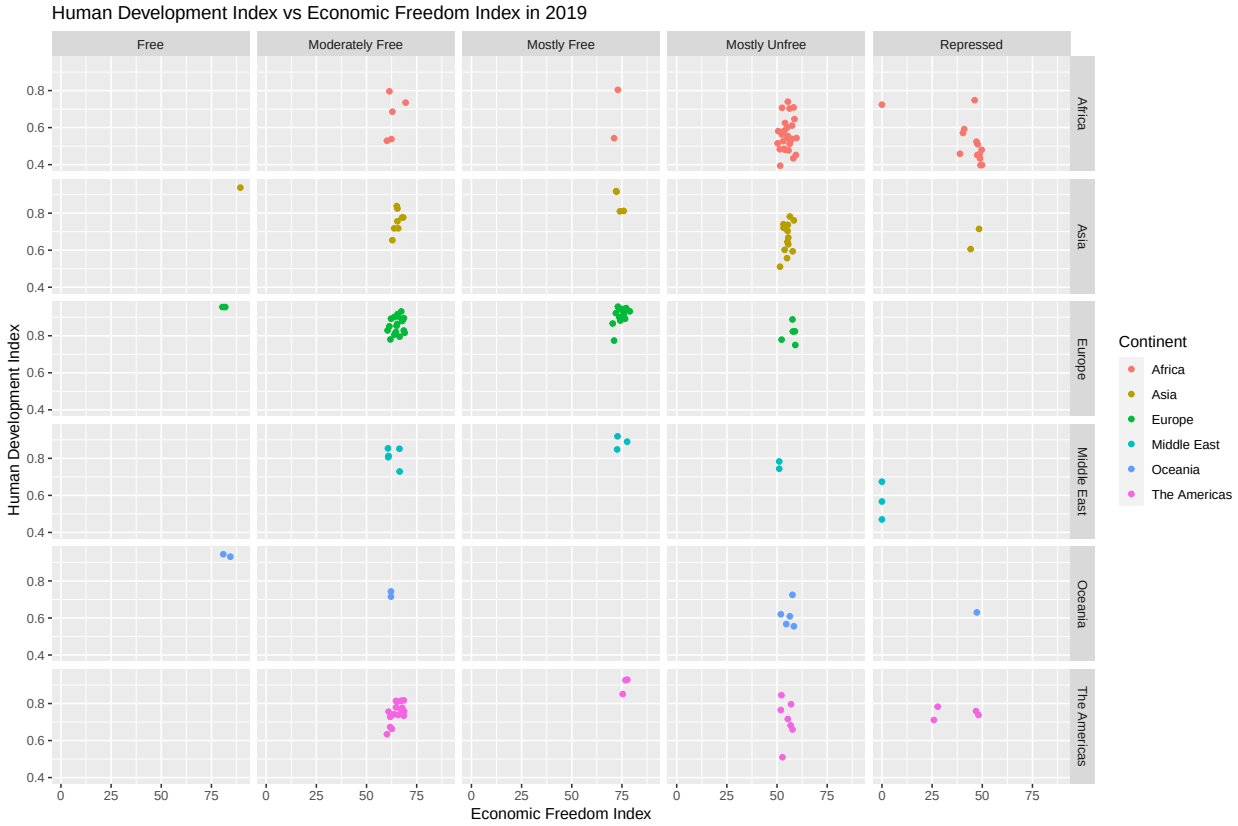
Average life expectancy across continents

```
df_world %>%
  filter(Year == 2019) %>%
  group_by(Continent) %>%
  summarize(mean_life = mean(Life_Expectancy, na.rm = TRUE)) %>%
  ggplot() +
  geom_bar(aes(x = Continent, y = mean_life,
               fill = Continent), stat = "identity") +
  labs(title = "Average life expectancy across continents",
       y = "Average life expectancy") +
  theme_classic()
```



Enhanced scatter plot for Human Development Index vs Economic Freedom Index

```
df_world %>%
  filter(Year == 2019) %>%
  ggplot() +
  geom_point(aes(x = Economic_Freedom_Index,
                 y = Human_Development_Index,
                color = Continent), na.rm = TRUE) +
  facet_grid(Continent ~ Free_Market_Class) +
  labs(title = sprintf("Human Development Index vs Economic Freedom Index in %d", 2019),
       x = "Economic Freedom Index",
       y = "Human Development Index")
```


Human Development Index vs Economic Freedom Index in 2019
Free
Moderately Free
Mostly Free
Mostly Unfree
Repressed
Africa
Asia
Europe
Middle East
Oceania
The Americas
Human Development Index
Economic Freedom Index
0.4
0.6
0.8
0
25
50
75
Continent
Africa
Asia
Europe
Middle East
Oceania
The Americas