

# World happiness

Group 21

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## Introduction

## Exploratory Data Analysis

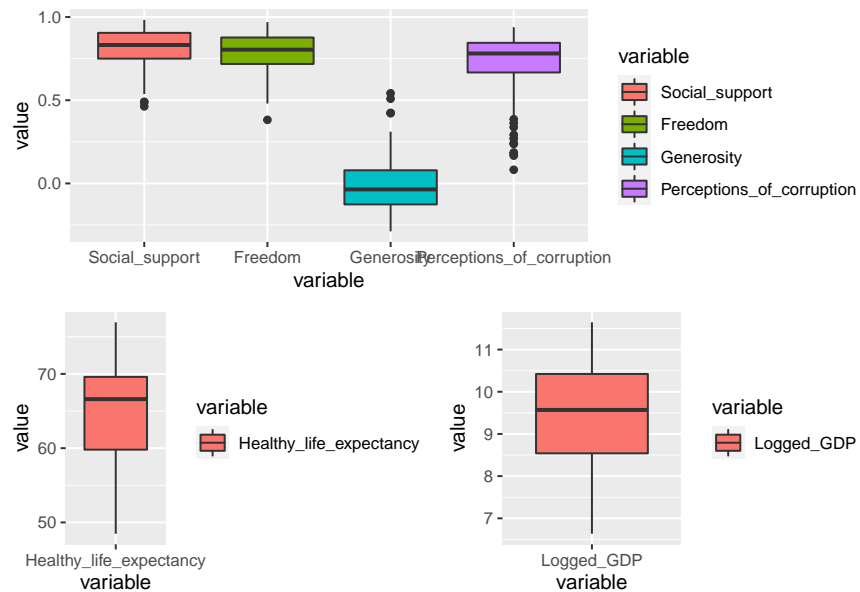


Figure 1: Boxplots.

Table 1: Summary statistics.

score	LoggedGDP	Social	expectancy	Freedom	Generosity	corruption
Min. :2.523	Min. : 6.635	Min. :0.4630	Min. :48.48	Min. :0.3820	Min. : -0.28800	Min. :0.0820
1st Qu.:4.852	1st Qu.: 8.541	1st Qu.:0.7500	1st Qu.:59.80	1st Qu.:0.7180	1st Qu.: -0.12600	1st Qu.:0.66
Median :5.534	Median : 9.569	Median :0.8320	Median :66.60	Median :0.8040	Median : -0.03600	Median :0.73
Mean :5.533	Mean : 9.432	Mean :0.8147	Mean :64.99	Mean :0.7916	Mean : -0.01513	Mean :0.727
3rd Qu.:6.255	3rd Qu.:10.421	3rd Qu.:0.9050	3rd Qu.:69.60	3rd Qu.:0.8770	3rd Qu.: 0.07900	3rd Qu.:0.84
Max. :7.842	Max. :11.647	Max. :0.9830	Max. :76.95	Max. :0.9700	Max. : 0.54200	Max. :0.939

## Visualization of the data

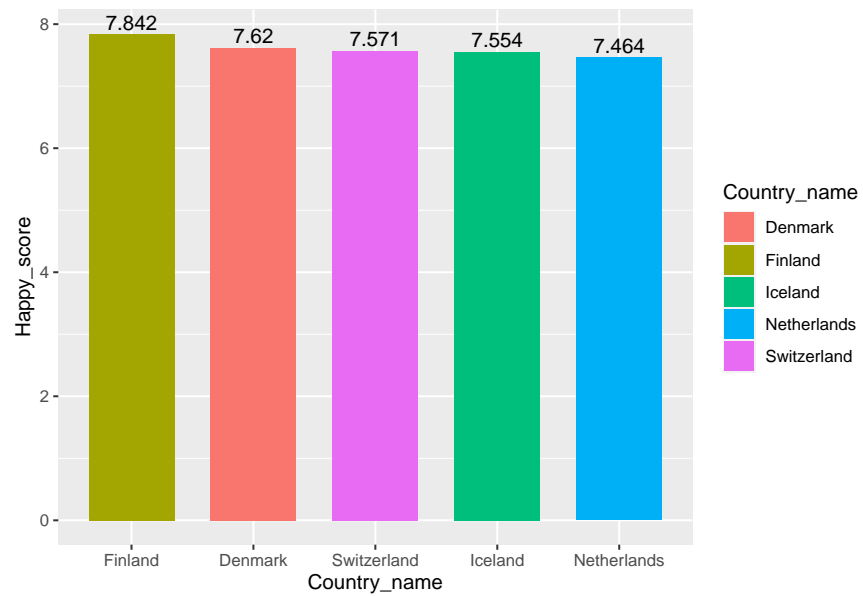


Figure 2: The 5 happiest contries.

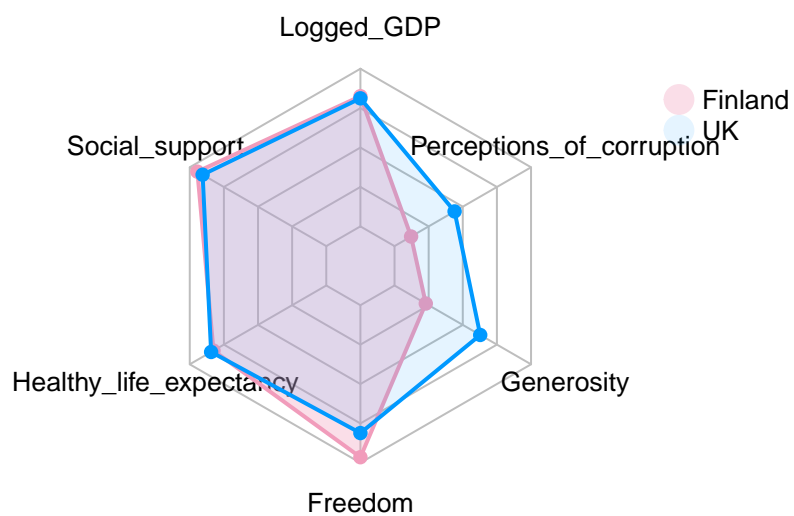


Figure 3: Finland versus UK.

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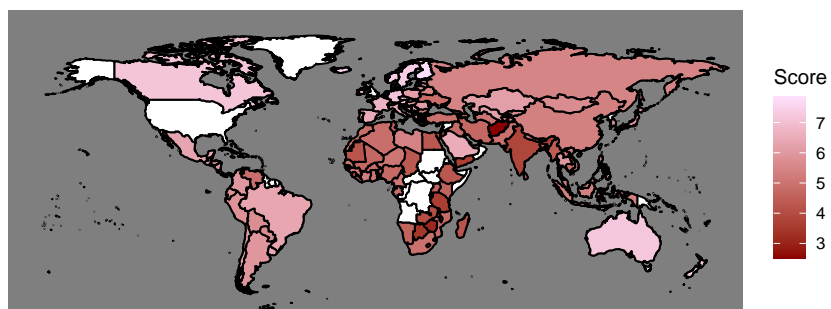


Figure 4: Map.

## Formal Data Analysis

To begin to analysis the world happiness dataset, we need to check the correlation between the six explanatory variables to avoid the problem of multicollinearity.

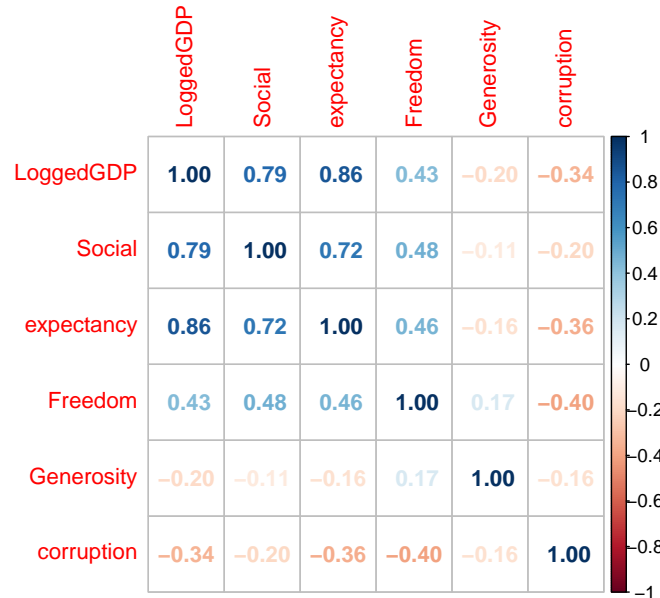


Figure 5: Correlation coefficient table.

From our correlation table we can see that the correlation between our Logged GDP and Healthy life expectancy is 0.859, which is a strong positive linear relationship. And the Logged GDP and Social support also have the high degree of collinearity, the correlation between this two variables is 0.785. So we remove Healthy life expectancy and Logged GDP. Then, using the remaining 4 explanatory variables to perform stepwise regression, and observe whether the remaining variables need to be eliminated.

```
Start: AIC=-141.88
score ~ Social + Freedom + Generosity + corruption
```

	Df	Sum of Sq	RSS	AIC
- Generosity	1	0.091	53.856	-143.628
<none>			53.765	-141.879
- corruption	1	6.078	59.843	-127.920
- Freedom	1	6.364	60.129	-127.210
- Social	1	43.953	97.718	-54.857

```
Step: AIC=-143.63
score ~ Social + Freedom + corruption
```

	Df	Sum of Sq	RSS	AIC
<none>			53.856	-143.628
- corruption	1	5.988	59.844	-129.919
- Freedom	1	6.325	60.181	-129.082
- Social	1	47.398	101.254	-51.561

Call:

```
lm(formula = score ~ Social + Freedom + corruption, data = happiness)
```

Coefficients:

(Intercept)	Social	Freedom	corruption
0.0779	5.6256	2.2271	-1.2254

According to the results of stepwise regression, we choose the model with the smallest AIC as the final model. Then, we fit the following linear model to the data.

$$\widehat{\text{score}}_i = \hat{\alpha} + \hat{\beta} * \text{Social}_i + \hat{\gamma} * \text{Freedom}_i + \hat{\delta} * \text{corruption}_i$$

where

- the  $\widehat{\text{score}}_i$ : the happiness score of the  $i$ th country.
- the  $\hat{\alpha}$ : the intercept of the regression line.
- the  $\hat{\beta}$ : the coefficient for the first explanatory variable Social.
- the  $\hat{\gamma}$ : the coefficient for the second explanatory variable Freedom.
- the  $\hat{\delta}$ : the coefficient for the second explanatory variable corruption.

When this model is fitted to the data, the following estimates of  $\alpha$  (intercept) and  $\beta, \gamma$  and  $\delta$  are returned:

Table 2: Estimates of the parameters from the fitted linear regression model.

term	estimate	std_error	statistic	p_value	lower_ci	upper_ci
intercept	0.078	0.559	0.139	0.889	-1.028	1.184
Social	5.626	0.498	11.297	0.000	4.641	6.610
Freedom	2.227	0.540	4.127	0.000	1.160	3.294
corruption	-1.225	0.305	-4.015	0.000	-1.829	-0.622

According to this table, the coefficient for social support tells us that, taking all other variables in the model into account and holding them constant, there is an associated increase, on average, every increase of 1 unit in the social support score increases the happiness index score by approximately 5.63 units. In the same way, when the freedom score of life choice increases by 1 unit, the happiness index score also increases by approximately 2.23 units. On the contrary, for every increase of 1 unit in the score for corruption, the total score of happiness index decreases by 1.23 units.

Before we can continue to use the fitted model, we must check the model's assumptions. It is best to consider these according to the residual plot in Figure 2.

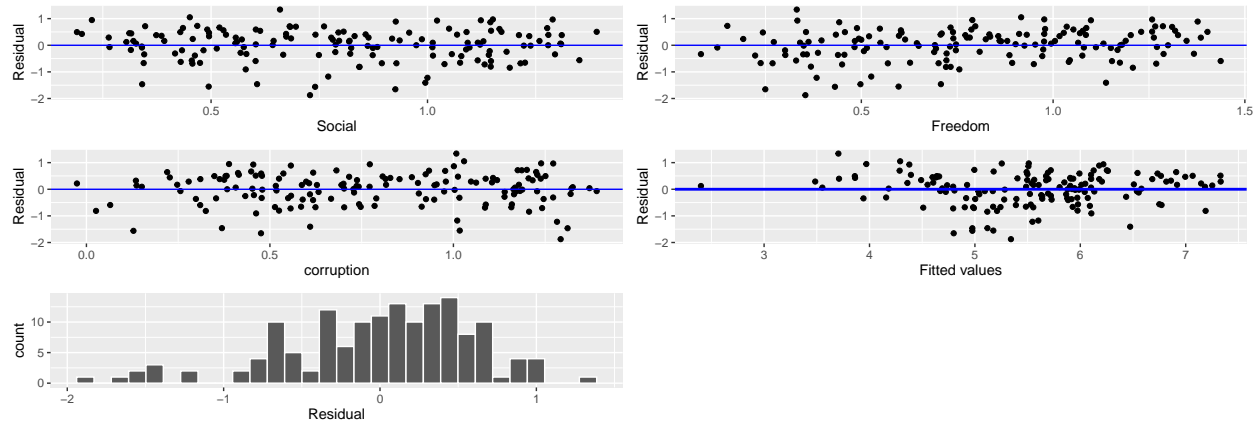


Figure 6: Scatterplots of the residuals by Social,Freedom,corruption,fitted value and the histogram of residuals.

The assumptions of the residuals having mean zero and constant variability across all values of the explanatory variable appear to be valid in this case. According to the three different explanatory variables scatter plots, it can be concluded that the residuals are uniformly distributed above and below the zero line, so the mean is 0. The residuals are randomly distributed around the zero line, and the distribution of the residuals is constant across all fitted values, so there is no obvious pattern or change in the variant. And also the histogram supports the assumption of normal distribution error.

## Conclusions