

STAT 420 Final Data Analysis Project - Team KWS

Introduction

Life expectancy varies greatly across the world. Understanding the factors that influence life expectancy can provide insights for policymakers, healthcare providers, and individuals. This project aims to delve into the determinants of life expectancy.

The dataset used is from the World Health Organization (WHO) and United Nations, which provides a wealth of data related to life expectancy across 193 countries. The dataset, publicly available on Kaggle under the title "Life Expectancy (WHO)", comprises 22 columns and 2,938 observations. Each observation represents the state of a given country in a particular year, with 20 predictor variables providing comprehensive information about various factors potentially impacting life expectancy.

The predictor variables span across a broad spectrum, including immunization-related factors, mortality factors, economic indicators, and social factors. Among these, we believe certain variables like the status of the country (developed vs developing), infant mortality rate, adult mortality rate, health expenditure, GDP, and average years of schooling may have significant importance in predicting life expectancy.

Our objective in this project is to create a model that can effectively predict life expectancy based on these predictors. We're particularly interested in this dataset due to our curiosity about the factors influencing life expectancy and our desire to uncover the differences between countries that lead to a wide range of life expectancies. By building this model, we aim to provide insights that could potentially guide health policy and contribute to improvements in global health outcomes.

Methods

Loading Data

```
#read data
library(readr)
life_expectancy_data_full = read_csv("Life Expectancy Data.csv")
```

```
## Rows: 2938 Columns: 22
## — Column specification —————
## Delimiter: ","
## chr (2): Country, Status
## dbl (20): Year, Life expectancy, Adult Mortality, infant deaths, Alcohol, pe...
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

We will remove rows with empty values to make analysis easier.

```
#remove rows with empty vals
life_expectancy_data = na.omit(life_expectancy_data_full)
View(life_expectancy_data)
```

For our analysis, we have chosen to convert the predictors Status and Country into factor variables, so that we can treat them as categories.

```
#convert Status (levels: Developing, Developed) to factor variable
life_expectancy_data$Status = as.factor(life_expectancy_data$Status)

#convert Country to factor variable
life_expectancy_data$Country = as.factor(life_expectancy_data$Country)
```

Exploratory Analysis

The pairs plot of all of the variables was very large, so we will display correlations between the numeric variables in the dataset with a Correlogram instead.

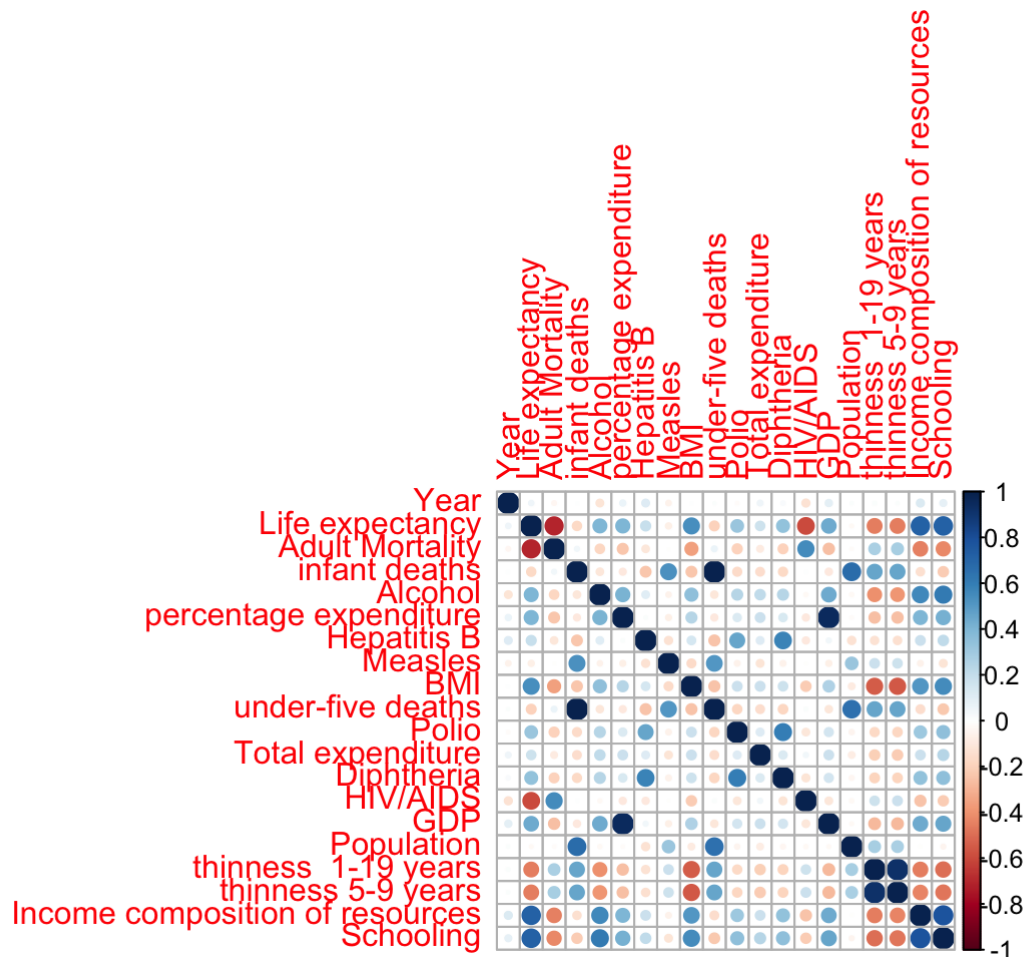
```
#pairs(life_expectancy_data)

#find pairwise correlations between all numeric variables in dataset
numeric_cols =  unlist(lapply(life_expectancy_data, is.numeric))
life_expectancy_data_numeric = life_expectancy_data[ , numeric_cols]
View(life_expectancy_data_numeric)

correlations = cor(life_expectancy_data_numeric)

#plot correlogram (positive correlations are blue, negative correlations are red)
library(corrplot)

corrplot(correlations)
```



We notice that there are a few variables with very high correlations, so we will attempt to address this issue in our modeling.

Initial Additive Model

First, we create a main effects model using all of the available predictors in the dataset to predict life expectancy.

```
additive_model = lm(life_expectancy_data$`Life expectancy` ~ ., data = life_expectancy_data)
#summary(additive_model)
```

Analyze Model

```
#Calculate LOOCV RMSE
calc_loocv_rmse = function(model) {
  sqrt(mean((resid(model) / (1 - hatvalues(model))) ^ 2))
}

# Function to calculate model metrics

calc_model_metrics = function(model) {
  # Calculate adjusted R squared
  model_adj_r2 = summary(model)$adj.r.squared

  # Calculate RMSE
  model_rmse = sqrt(mean(resid(model) ^ 2))

  # Calculate LOOCV RMSE
  model_loocv_rmse = sqrt(mean((resid(model) / (1 - hatvalues(model))) ^ 2))

  # Calculate AIC
  model_AIC = extractAIC(model)[2] # get only the AIC value, not the degrees of freedom

  # Return a list containing the calculated metrics
  list(Adj_R_Squared = model_adj_r2, RMSE = model_rmse, LOOCV_RMSE = model_loocv_rmse, AIC = model_AIC)
}

additive_model_metrics = as.data.frame(calc_model_metrics(additive_model))

library(knitr)
knitr::kable(additive_model_metrics, caption = "Additive Model Summary", digits = 4)
```

Additive Model Summary

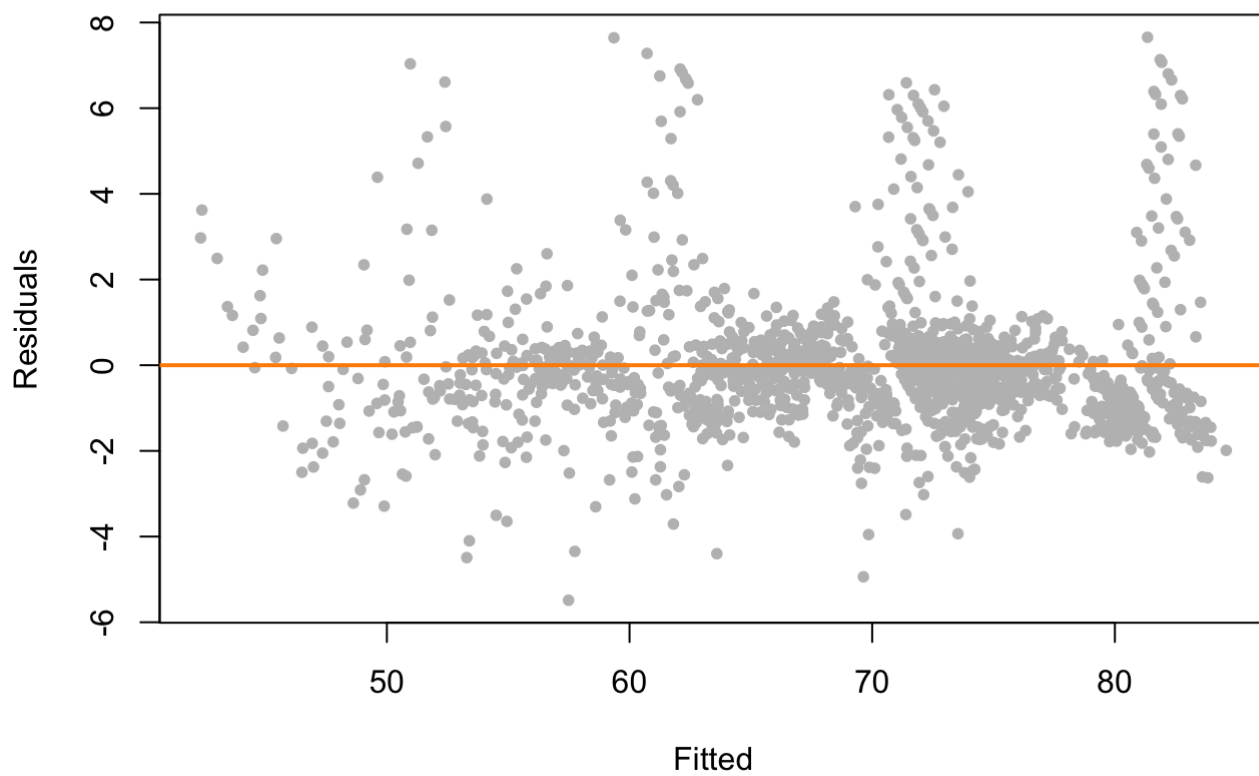
Adj_R_Squared	RMSE	LOOCV_RMSE	AIC
0.9642	1.5859	1.7559	1824.977

Check model assumptions

```
#Fitted vs Residuals Plot

plot(fitted(additive_model), resid(additive_model), col = "grey", pch = 20,
      xlab = "Fitted", ylab = "Residuals", main = "Data from Model 1")
abline(h = 0, col = "darkorange", lwd = 2)
```

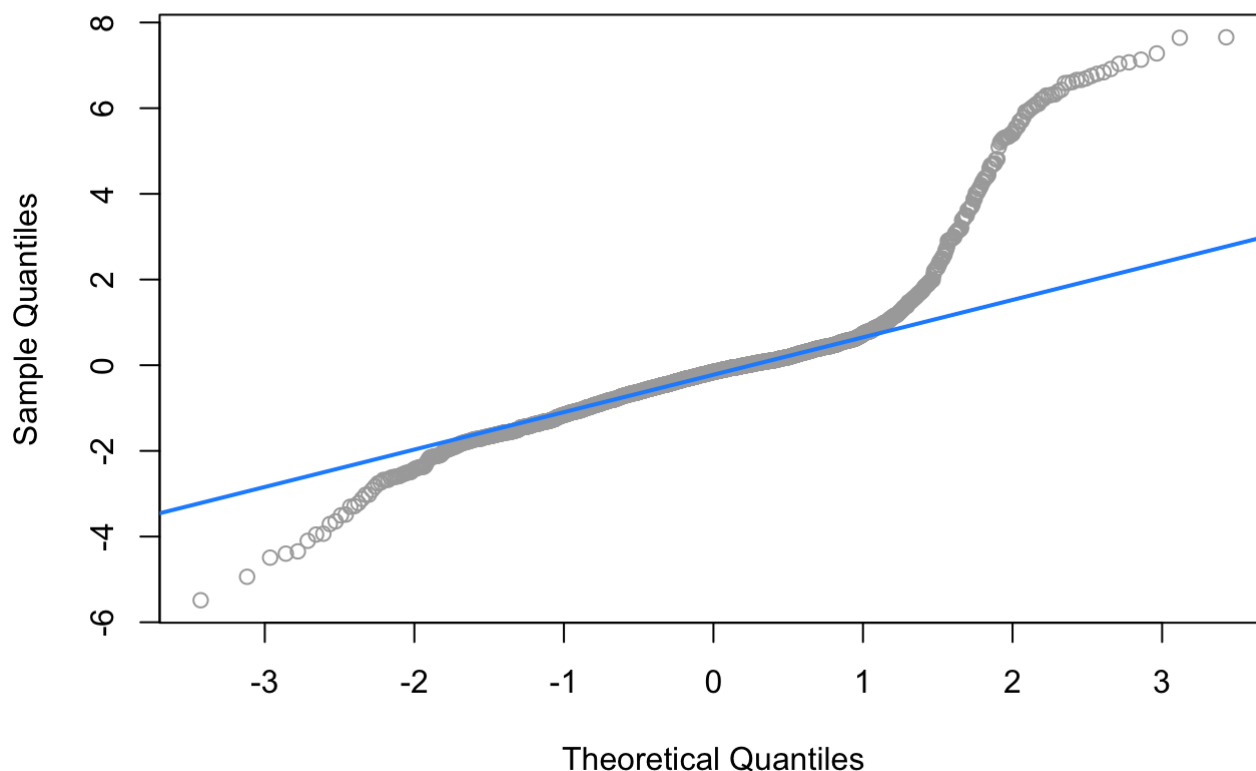
Data from Model 1



#Q-Q Plot

```
qqnorm(resid(additive_model), main = "Normal Q-Q Plot, fit_1", col = "darkgrey")  
qqline(resid(additive_model), col = "dodgerblue", lwd = 2)
```

Normal Q-Q Plot, fit_1



The fitted vs residuals plot and Q-Q plot suggest issues with this model's assumptions, which we will confirm via more formal tests.

```
library(lmtest)
bptest(additive_model)
```

```
##
## studentized Breusch-Pagan test
##
## data: additive_model
## BP = 283.35, df = 151, p-value = 4.012e-10
```

```
shapiro.test(resid(additive_model))
```

```
##
## Shapiro-Wilk normality test
##
## data: resid(additive_model)
## W = 0.82427, p-value < 2.2e-16
```

The results of the Breusch-Pagan test and the Shapiro-Wilk test confirm that this model violates both the constant variance assumption and the normality assumption. We will attempt to improve these issues below.

Model Improvement: Removing Highly Correlated Variables

We will attempt to fix these issues by removing highly correlated predictors. In particular, the variables `thinness 1-19 years` and `thinness 5-9 years` had a correlation of 0.997. In addition, the variables `under 5 death` and `infant death` had a correlation of 0.928. We'll remove one from each of the above pairs of predictors and reassess the model.

```
#----- Next step -----

#Removing infant deaths and thinness 1-19 years
corr_removed_data_1 = life_expectancy_data[ , !(names(life_expectancy_data) %in% c('infant deaths', 'thinness 1-19 years'))]
corr_removed_model_1 = lm(`Life expectancy` ~ ., data = corr_removed_data_1)
corr_removed_metrics_1 = calc_model_metrics(corr_removed_model_1)

#Removing infant deaths and thinness 5-9 years
corr_removed_data_2 = life_expectancy_data[ , !(names(life_expectancy_data) %in% c('infant deaths', 'thinness 5-9 years'))]
corr_removed_model_2 = lm(`Life expectancy` ~ ., data = corr_removed_data_2)
corr_removed_metrics_2 = calc_model_metrics(corr_removed_model_2)

#Removing under 5 deaths and thinness 1-19 years
corr_removed_data_3 = life_expectancy_data[ , !(names(life_expectancy_data) %in% c('under 5 death', 'thinness 1-19 years'))]
corr_removed_model_3 = lm(`Life expectancy` ~ ., data = corr_removed_data_3)
corr_removed_metrics_3 = calc_model_metrics(corr_removed_model_3)

#Removing under 5 deaths and thinness 5-9 years
corr_removed_data_4 = life_expectancy_data[ , !(names(life_expectancy_data) %in% c('under 5 death', 'thinness 5-9 years'))]
corr_removed_model_4 = lm(`Life expectancy` ~ ., data = corr_removed_data_4)
corr_removed_metrics_4 = calc_model_metrics(corr_removed_model_4)

# Create a data frame summarizing the model metrics
model_summary = data.frame(
  Variables_Removed = c("infant deaths + thinness 1-19", "infant deaths + thinness 5-9",
    "under 5 deaths + thinness 1-19", "under 5 deaths + thinness 5-9 years"),
  Adjusted_R_Squared = c(corr_removed_metrics_1$Adj_R_Squared, corr_removed_metrics_2$Adj_R_Squared, corr_removed_metrics_3$Adj_R_Squared, corr_removed_metrics_4$Adj_R_Squared),
  RMSE = c(corr_removed_metrics_1$RMSE, corr_removed_metrics_2$RMSE, corr_removed_metrics_3$RMSE, corr_removed_metrics_4$RMSE),
  LOOCV_RMSE = c(corr_removed_metrics_1$LOOCV_RMSE, corr_removed_metrics_2$LOOCV_RMSE, corr_removed_metrics_3$LOOCV_RMSE, corr_removed_metrics_4$LOOCV_RMSE),
  AIC = c(corr_removed_metrics_1$AIC, corr_removed_metrics_2$AIC, corr_removed_metrics_3$AIC, corr_removed_metrics_4$AIC)
)

library(knitr)
knitr::kable(model_summary, caption = "Model Summary", digits = 4)
```

Model Summary

Variables_Removed	Adjusted_R_Squared	RMSE	LOOCV_RMSE	AIC
infant deaths + thinness 1-19	0.9640	1.5914	1.7576	1834.247

Variables_Removed	Adjusted_R_Squared	RMSE	LOOCV_RMSE	AIC
infant deaths + thinness 5-9	0.9639	1.5937	1.7590	1837.088
under 5 deaths + thinness 1-19	0.9642	1.5859	1.7559	1824.977
under 5 deaths + thinness 5-9 years	0.9641	1.5883	1.7572	1827.939

Our analysis suggests that removing the variables `under 5 deaths` and `thinness 1-19` results in the most model improvement. However, the resulting AIC of this model is still large, so we need to further improve the model.

Model Improvement: Log Transformation of Predictor Variables

We will attempt to further improve the model by log transforming certain predictor variables (`Population` and `GDP`).

```
#----- Next step -----

log_transform_1 = lm(`Life expectancy` ~ . + log(Population) + log(GDP), data = life_exp
ectancy_data)
log_transformed_metrics_1 = calc_model_metrics(log_transform_1)

log_transform_2 = lm(`Life expectancy` ~ . + log(GDP), data = life_expectancy_data)
log_transformed_metrics_2 = calc_model_metrics(log_transform_2)

log_transform_3 = lm(`Life expectancy` ~ . + log(Population), data = life_expectancy_dat
a)
log_transformed_metrics_3 = calc_model_metrics(log_transform_3)

log_model_summary = data.frame(
  Variables_Log_Transformed = c("Population + GDP", "GDP", "Population"),
  Adjusted_R_Squared = c(log_transformed_metrics_1$Adj_R_Squared, log_transformed_metric
s_2$Adj_R_Squared, log_transformed_metrics_3$Adj_R_Squared),
  RMSE = c(log_transformed_metrics_1$RMSE, log_transformed_metrics_2$RMSE, log_transform
ed_metrics_3$RMSE),
  LOOCV_RMSE = c(log_transformed_metrics_1$LOOCV_RMSE, log_transformed_metrics_2$LOOCV_R
MSE, log_transformed_metrics_3$LOOCV_RMSE),
  AIC = c(log_transformed_metrics_1$AIC, log_transformed_metrics_2$AIC, log_transformed_
metrics_3$AIC)
)

knitr::kable(log_model_summary, caption = "Log Transformed Model Summary", digits = 4)
```

Log Transformed Model Summary

Variables_Log_Transformed	Adjusted_R_Squared	RMSE	LOOCV_RMSE	AIC
Population + GDP	0.9642	1.5853	1.7583	1827.612
GDP	0.9642	1.5853	1.7569	1825.613

Variables_Log_Transformed	Adjusted_R_Squared	RMSE	LOOCV_RMSE	AIC
Population	0.9642	1.5859	1.7574	1826.977

Experimenting with various log transformations of the predictor variables `Population` and `GDP` suggests that log transformation of `GDP` resulted in a minimal improvement in AIC.

```
n = length(resid(additive_model))
```

```
#----- Next step -----
```

```
#We will use AIC and BIC backwards search to attempt to further improve the model
```

```
#AIC and BIC for additive models
```

```
additive_mod_back_aic = step(additive_model, direction = "backward")
```

```

## Start: AIC=1824.98
## life_expectancy_data$`Life expectancy` ~ Country + Year + Status +
##   `Adult Mortality` + `infant deaths` + Alcohol + `percentage expenditure` +
##   `Hepatitis B` + Measles + BMI + `under-five deaths` + Polio +
##   `Total expenditure` + Diphtheria + `HIV/AIDS` + GDP + Population +
##   `thinness 1-19 years` + `thinness 5-9 years` + `Income composition of resources`
+
##   Schooling
##
##
## Step: AIC=1824.98
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
##           Df Sum of Sq    RSS    AIC
## - Polio      1      0.1 4147.8 1823.0
## - Diphtheria  1      0.2 4147.9 1823.1
## - Population  1      0.3 4147.9 1823.1
## - `thinness 1-19 years`  1      0.3 4148.0 1823.1
## - BMI         1      0.5 4148.1 1823.2
## - `percentage expenditure`  1      1.1 4148.7 1823.4
## - GDP         1      1.6 4149.3 1823.6
## - `Total expenditure`  1      1.9 4149.6 1823.7
## - Measles     1      2.8 4150.5 1824.1
## - `Adult Mortality`  1      3.9 4151.6 1824.5
## - `Hepatitis B`  1      4.8 4152.4 1824.9
## <none>                                4147.6 1825.0
## - `Income composition of resources`  1      7.6 4155.2 1826.0
## - `thinness 5-9 years`  1     12.5 4160.1 1827.9
## - Alcohol     1     12.8 4160.4 1828.1
## - `infant deaths`  1     28.4 4176.1 1834.2
## - `under-five deaths`  1     32.1 4179.7 1835.7
## - Schooling   1     37.0 4184.6 1837.6
## - Year        1    456.5 4604.1 1995.2
## - `HIV/AIDS`   1    1016.8 5164.4 2184.5
## - Country     132   16527.0 20674.7 4209.9
##
## Step: AIC=1823.04
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
##           Df Sum of Sq    RSS    AIC
## - Diphtheria  1      0.2 4147.9 1821.1
## - Population  1      0.3 4148.0 1821.2

```

```

## - `thinness 1-19 years`      1      0.3  4148.1 1821.2
## - BMI                        1      0.5  4148.3 1821.2
## - `percentage expenditure`   1      1.1  4148.8 1821.5
## - GDP                        1      1.6  4149.4 1821.7
## - `Total expenditure`       1      2.0  4149.7 1821.8
## - Measles                    1      2.9  4150.6 1822.2
## - `Adult Mortality`         1      3.9  4151.7 1822.6
## - `Hepatitis B`             1      4.7  4152.4 1822.9
## <none>                       4147.8 1823.0
## - `Income composition of resources` 1      7.6  4155.4 1824.1
## - `thinness 5-9 years`      1     12.6  4160.3 1826.0
## - Alcohol                    1     12.8  4160.5 1826.1
## - `infant deaths`           1     28.6  4176.4 1832.4
## - `under-five deaths`       1     32.2  4180.0 1833.8
## - Schooling                  1     36.9  4184.7 1835.6
## - Year                       1    456.6  4604.4 1993.2
## - `HIV/AIDS`                1   1016.7  5164.4 2182.5
## - Country                    132  16542.4 20690.1 4209.1
##
## Step: AIC=1821.1
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + `Total expenditure` +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##                                     Df Sum of Sq      RSS      AIC
## - Population                       1      0.3  4148.2 1819.2
## - `thinness 1-19 years`            1      0.3  4148.2 1819.2
## - BMI                             1      0.5  4148.4 1819.3
## - `percentage expenditure`         1      1.1  4149.0 1819.5
## - GDP                             1      1.6  4149.5 1819.7
## - `Total expenditure`             1      2.0  4149.9 1819.9
## - Measles                         1      2.8  4150.8 1820.2
## - `Adult Mortality`               1      3.9  4151.8 1820.7
## <none>                             4147.9 1821.1
## - `Hepatitis B`                   1      7.1  4155.0 1821.9
## - `Income composition of resources` 1      7.9  4155.8 1822.2
## - `thinness 5-9 years`            1     12.6  4160.5 1824.1
## - Alcohol                         1     12.8  4160.7 1824.2
## - `infant deaths`                 1     28.9  4176.9 1830.6
## - `under-five deaths`             1     32.6  4180.5 1832.0
## - Schooling                       1     37.1  4185.0 1833.8
## - Year                           1    456.9  4604.9 1991.4
## - `HIV/AIDS`                     1   1020.4  5168.3 2181.8
## - Country                         132  16656.3 20804.2 4216.2
##
## Step: AIC=1819.21
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + `Total expenditure` +

```

```
##      `HIV/AIDS` + GDP + `thinness 1-19 years` + `thinness 5-9 years` +
##      `Income composition of resources` + Schooling
##
##                                     Df Sum of Sq      RSS      AIC
## - `thinness 1-19 years`           1         0.3  4148.5  1817.3
## - BMI                             1         0.5  4148.7  1817.4
## - `percentage expenditure`        1         1.1  4149.3  1817.6
## - GDP                             1         1.6  4149.8  1817.9
## - `Total expenditure`             1         1.9  4150.1  1818.0
## - Measles                         1         3.0  4151.2  1818.4
## - `Adult Mortality`               1         4.0  4152.2  1818.8
## <none>                             4148.2  1819.2
## - `Hepatitis B`                   1         7.0  4155.2  1820.0
## - `Income composition of resources` 1         7.9  4156.1  1820.4
## - Alcohol                         1        12.9  4161.1  1822.3
## - `thinness 5-9 years`            1        12.9  4161.1  1822.3
## - `infant deaths`                 1        29.6  4177.8  1828.9
## - `under-five deaths`             1        32.9  4181.1  1830.2
## - Schooling                       1        36.9  4185.1  1831.8
## - Year                            1       456.7  4604.9  1989.4
## - `HIV/AIDS`                     1       1021.7  5169.9  2180.3
## - Country                         132     16656.9 20805.1  4214.3
##
## Step:  AIC=1817.32
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##      `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##      Measles + BMI + `under-five deaths` + `Total expenditure` +
##      `HIV/AIDS` + GDP + `thinness 5-9 years` + `Income composition of resources` +
##      Schooling
##
##                                     Df Sum of Sq      RSS      AIC
## - BMI                             1         0.5  4149.0  1815.5
## - `percentage expenditure`        1         1.1  4149.5  1815.7
## - GDP                             1         1.6  4150.1  1816.0
## - `Total expenditure`             1         1.9  4150.4  1816.1
## - Measles                         1         2.9  4151.4  1816.5
## - `Adult Mortality`               1         4.0  4152.5  1816.9
## <none>                             4148.5  1817.3
## - `Hepatitis B`                   1         7.1  4155.6  1818.1
## - `Income composition of resources` 1         7.9  4156.4  1818.5
## - Alcohol                         1        12.8  4161.3  1820.4
## - `thinness 5-9 years`            1        22.2  4170.7  1824.1
## - `infant deaths`                 1        29.4  4177.9  1827.0
## - `under-five deaths`             1        32.7  4181.2  1828.3
## - Schooling                       1        36.8  4185.3  1829.9
## - Year                            1       456.5  4605.0  1987.5
## - `HIV/AIDS`                     1       1021.7  5170.1  2178.4
## - Country                         132     16656.6 20805.1  4212.3
##
## Step:  AIC=1815.52
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##      `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
```

```

##      Measles + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##      GDP + `thinness 5-9 years` + `Income composition of resources` +
##      Schooling
##
##              Df Sum of Sq      RSS      AIC
## - `percentage expenditure`      1      1.2  4150.2  1814.0
## - GDP                          1      1.7  4150.7  1814.2
## - `Total expenditure`          1      1.8  4150.8  1814.3
## - Measles                      1      3.0  4152.0  1814.7
## - `Adult Mortality`           1      4.0  4153.0  1815.1
## <none>                        4149.0  1815.5
## - `Hepatitis B`               1      6.9  4155.9  1816.3
## - `Income composition of resources` 1      7.7  4156.6  1816.6
## - Alcohol                     1     12.8  4161.8  1818.6
## - `thinness 5-9 years`        1     22.4  4171.4  1822.4
## - `infant deaths`            1     29.4  4178.4  1825.2
## - `under-five deaths`        1     32.7  4181.7  1826.5
## - Schooling                   1     36.8  4185.8  1828.1
## - Year                       1    456.8  4605.8  1985.8
## - `HIV/AIDS`                 1    1026.4  5175.4  2178.0
## - Country                    132   16982.3 21131.3  4235.9
##
## Step:  AIC=1813.99
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##      `infant deaths` + Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##      `Total expenditure` + `HIV/AIDS` + GDP + `thinness 5-9 years` +
##      `Income composition of resources` + Schooling
##
##              Df Sum of Sq      RSS      AIC
## - GDP                          1      0.9  4151.0  1812.3
## - `Total expenditure`          1      1.9  4152.1  1812.7
## - Measles                      1      3.0  4153.2  1813.2
## - `Adult Mortality`           1      4.0  4154.1  1813.6
## <none>                        4150.2  1814.0
## - `Hepatitis B`               1      7.0  4157.2  1814.8
## - `Income composition of resources` 1      7.7  4157.8  1815.0
## - Alcohol                     1     12.5  4162.7  1817.0
## - `thinness 5-9 years`        1     22.3  4172.5  1820.8
## - `infant deaths`            1     29.1  4179.2  1823.5
## - `under-five deaths`        1     32.4  4182.5  1824.8
## - Schooling                   1     37.5  4187.6  1826.8
## - Year                       1    459.9  4610.1  1985.3
## - `HIV/AIDS`                 1    1025.3  5175.4  2176.0
## - Country                    132   17019.7 21169.8  4236.9
##
## Step:  AIC=1812.34
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##      `infant deaths` + Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##      `Total expenditure` + `HIV/AIDS` + `thinness 5-9 years` +
##      `Income composition of resources` + Schooling
##
##              Df Sum of Sq      RSS      AIC

```

```

## - `Total expenditure`      1      1.8  4152.9 1811.1
## - Measles                  1      3.0  4154.0 1811.5
## - `Adult Mortality`       1      3.9  4155.0 1811.9
## <none>                     4151.0 1812.3
## - `Hepatitis B`           1      6.9  4158.0 1813.1
## - `Income composition of resources` 1      7.5  4158.5 1813.3
## - Alcohol                  1     12.3  4163.3 1815.2
## - `thinness 5-9 years`    1     22.3  4173.4 1819.2
## - `infant deaths`         1     29.0  4180.0 1821.8
## - `under-five deaths`     1     32.3  4183.3 1823.1
## - Schooling                1     37.0  4188.0 1825.0
## - Year                     1    483.5  4634.5 1992.0
## - `HIV/AIDS`              1   1024.5  5175.5 2174.1
## - Country                  132  17885.0 22036.0 4301.0
##
## Step: AIC=1811.06
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##   `infant deaths` + Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##              Df Sum of Sq    RSS    AIC
## - Measles      1      2.9  4155.7 1810.2
## - `Adult Mortality` 1      3.9  4156.8 1810.6
## <none>          4152.9 1811.1
## - `Hepatitis B` 1      6.7  4159.6 1811.7
## - `Income composition of resources` 1      7.6  4160.4 1812.1
## - Alcohol       1     12.2  4165.0 1813.9
## - `thinness 5-9 years` 1     22.2  4175.1 1817.9
## - `infant deaths` 1     29.1  4181.9 1820.6
## - `under-five deaths` 1     32.4  4185.2 1821.9
## - Schooling     1     37.2  4190.0 1823.8
## - Year          1    481.7  4634.5 1990.0
## - `HIV/AIDS`    1   1022.7  5175.5 2172.1
## - Country       132  18014.7 22167.6 4308.9
##
## Step: AIC=1810.2
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##   `infant deaths` + Alcohol + `Hepatitis B` + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##              Df Sum of Sq    RSS    AIC
## - `Adult Mortality` 1      3.9  4159.6 1809.7
## <none>          4155.7 1810.2
## - `Hepatitis B`    1      6.8  4162.5 1810.9
## - `Income composition of resources` 1      7.5  4163.2 1811.2
## - Alcohol          1     12.2  4167.9 1813.0
## - `thinness 5-9 years` 1     22.8  4178.5 1817.2
## - `infant deaths`  1     27.4  4183.2 1819.0
## - `under-five deaths` 1     31.0  4186.7 1820.4
## - Schooling        1     38.3  4194.0 1823.3

```

```
## - Year          1      482.8  4638.5 1989.4
## - `HIV/AIDS`    1      1021.8  5177.5 2170.7
## - Country       132     18052.6 22208.3 4309.9
##
## Step:  AIC=1809.74
## life_expectancy_data$`Life expectancy` ~ Country + Year + `infant deaths` +
##   Alcohol + `Hepatitis B` + `under-five deaths` + `HIV/AIDS` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##              Df Sum of Sq    RSS    AIC
## <none>                4159.6 1809.7
## - `Hepatitis B`        1         6.6 4166.2 1810.3
## - `Income composition of resources` 1         7.7 4167.3 1810.8
## - Alcohol              1        12.3 4171.9 1812.6
## - `thinness 5-9 years` 1        22.9 4182.5 1816.8
## - `infant deaths`      1        27.4 4187.0 1818.6
## - `under-five deaths`  1        30.8 4190.4 1819.9
## - Schooling            1        38.6 4198.2 1823.0
## - Year                 1       489.2 4648.8 1991.1
## - `HIV/AIDS`          1      1071.3 5230.9 2185.6
## - Country              132     22622.6 26782.2 4616.7
```

```
additive_mod_back_bic = step(additive_model, direction = "backward", k = log(n))
```



```

## Start: AIC=2646.98
## life_expectancy_data$`Life expectancy` ~ Country + Year + Status +
##   `Adult Mortality` + `infant deaths` + Alcohol + `percentage expenditure` +
##   `Hepatitis B` + Measles + BMI + `under-five deaths` + Polio +
##   `Total expenditure` + Diphtheria + `HIV/AIDS` + GDP + Population +
##   `thinness 1-19 years` + `thinness 5-9 years` + `Income composition of resources`
##   +
##   Schooling
##
## Step: AIC=2646.98
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##           Df Sum of Sq    RSS    AIC
## - Polio      1      0.1 4147.8 2639.6
## - Diphtheria  1      0.2 4147.9 2639.7
## - Population  1      0.3 4147.9 2639.7
## - `thinness 1-19 years`  1      0.3 4148.0 2639.7
## - BMI         1      0.5 4148.1 2639.8
## - `percentage expenditure`  1      1.1 4148.7 2640.0
## - GDP         1      1.6 4149.3 2640.2
## - `Total expenditure`  1      1.9 4149.6 2640.3
## - Measles     1      2.8 4150.5 2640.7
## - `Adult Mortality`  1      3.9 4151.6 2641.1
## - `Hepatitis B`    1      4.8 4152.4 2641.5
## - `Income composition of resources`  1      7.6 4155.2 2642.6
## - `thinness 5-9 years`  1     12.5 4160.1 2644.5
## - Alcohol      1     12.8 4160.4 2644.7
## <none>                4147.6 2647.0
## - `infant deaths`  1     28.4 4176.1 2650.8
## - `under-five deaths`  1     32.1 4179.7 2652.3
## - Schooling      1     37.0 4184.6 2654.2
## - Year           1    456.5 4604.1 2811.8
## - `HIV/AIDS`     1   1016.8 5164.4 3001.1
## - Country       132  16527.0 20674.7 4318.0
##
## Step: AIC=2639.63
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##           Df Sum of Sq    RSS    AIC
## - Diphtheria      1      0.2 4147.9 2632.3
## - Population       1      0.3 4148.0 2632.3

```

```

## - `thinness 1-19 years`      1      0.3  4148.1 2632.3
## - BMI                        1      0.5  4148.3 2632.4
## - `percentage expenditure`   1      1.1  4148.8 2632.6
## - GDP                        1      1.6  4149.4 2632.9
## - `Total expenditure`       1      2.0  4149.7 2633.0
## - Measles                    1      2.9  4150.6 2633.4
## - `Adult Mortality`         1      3.9  4151.7 2633.8
## - `Hepatitis B`             1      4.7  4152.4 2634.1
## - `Income composition of resources` 1      7.6  4155.4 2635.2
## - `thinness 5-9 years`      1     12.6  4160.3 2637.2
## - Alcohol                    1     12.8  4160.5 2637.3
## <none>                       4147.8 2639.6
## - `infant deaths`           1     28.6  4176.4 2643.6
## - `under-five deaths`       1     32.2  4180.0 2645.0
## - Schooling                  1     36.9  4184.7 2646.8
## - Year                       1    456.6  4604.4 2804.4
## - `HIV/AIDS`                1   1016.7  5164.4 2993.7
## - Country                    132  16542.4 20690.1 4311.9
##
## Step: AIC=2632.29
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + `Total expenditure` +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##                                     Df Sum of Sq      RSS      AIC
## - Population                        1      0.3  4148.2 2625.0
## - `thinness 1-19 years`             1      0.3  4148.2 2625.0
## - BMI                              1      0.5  4148.4 2625.1
## - `percentage expenditure`          1      1.1  4149.0 2625.3
## - GDP                              1      1.6  4149.5 2625.5
## - `Total expenditure`               1      2.0  4149.9 2625.7
## - Measles                          1      2.8  4150.8 2626.0
## - `Adult Mortality`                 1      3.9  4151.8 2626.4
## - `Hepatitis B`                     1      7.1  4155.0 2627.7
## - `Income composition of resources` 1      7.9  4155.8 2628.0
## - `thinness 5-9 years`              1     12.6  4160.5 2629.9
## - Alcohol                          1     12.8  4160.7 2629.9
## <none>                              4147.9 2632.3
## - `infant deaths`                   1     28.9  4176.9 2636.3
## - `under-five deaths`               1     32.6  4180.5 2637.8
## - Schooling                         1     37.1  4185.0 2639.6
## - Year                             1    456.9  4604.9 2797.2
## - `HIV/AIDS`                       1   1020.4  5168.3 2987.6
## - Country                          132  16656.3 20804.2 4313.5
##
## Step: AIC=2624.99
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + `Total expenditure` +

```

```
##      `HIV/AIDS` + GDP + `thinness 1-19 years` + `thinness 5-9 years` +
##      `Income composition of resources` + Schooling
##
##                                     Df Sum of Sq      RSS      AIC
## - `thinness 1-19 years`           1         0.3  4148.5  2617.7
## - BMI                             1         0.5  4148.7  2617.8
## - `percentage expenditure`        1         1.1  4149.3  2618.0
## - GDP                             1         1.6  4149.8  2618.2
## - `Total expenditure`             1         1.9  4150.1  2618.4
## - Measles                         1         3.0  4151.2  2618.8
## - `Adult Mortality`               1         4.0  4152.2  2619.2
## - `Hepatitis B`                   1         7.0  4155.2  2620.4
## - `Income composition of resources` 1         7.9  4156.1  2620.7
## - Alcohol                         1        12.9  4161.1  2622.7
## - `thinness 5-9 years`            1        12.9  4161.1  2622.7
## <none>                             4148.2  2625.0
## - `infant deaths`                 1        29.6  4177.8  2629.3
## - `under-five deaths`             1        32.9  4181.1  2630.6
## - Schooling                       1        36.9  4185.1  2632.2
## - Year                            1       456.7  4604.9  2789.8
## - `HIV/AIDS`                     1       1021.7  5169.9  2980.7
## - Country                         132     16656.9 20805.1  4306.2
##
## Step:  AIC=2617.69
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##      `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##      Measles + BMI + `under-five deaths` + `Total expenditure` +
##      `HIV/AIDS` + GDP + `thinness 5-9 years` + `Income composition of resources` +
##      Schooling
##
##                                     Df Sum of Sq      RSS      AIC
## - BMI                             1         0.5  4149.0  2610.5
## - `percentage expenditure`        1         1.1  4149.5  2610.7
## - GDP                             1         1.6  4150.1  2610.9
## - `Total expenditure`             1         1.9  4150.4  2611.1
## - Measles                         1         2.9  4151.4  2611.5
## - `Adult Mortality`               1         4.0  4152.5  2611.9
## - `Hepatitis B`                   1         7.1  4155.6  2613.1
## - `Income composition of resources` 1         7.9  4156.4  2613.4
## - Alcohol                         1        12.8  4161.3  2615.4
## <none>                             4148.5  2617.7
## - `thinness 5-9 years`            1        22.2  4170.7  2619.1
## - `infant deaths`                 1        29.4  4177.9  2621.9
## - `under-five deaths`             1        32.7  4181.2  2623.2
## - Schooling                       1        36.8  4185.3  2624.9
## - Year                            1       456.5  4605.0  2782.4
## - `HIV/AIDS`                     1       1021.7  5170.1  2973.3
## - Country                         132     16656.6 20805.1  4298.8
##
## Step:  AIC=2610.49
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##      `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
```

```

##      Measles + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##      GDP + `thinness 5-9 years` + `Income composition of resources` +
##      Schooling
##
##              Df Sum of Sq      RSS      AIC
## - `percentage expenditure`      1      1.2 4150.2 2603.5
## - GDP                          1      1.7 4150.7 2603.8
## - `Total expenditure`          1      1.8 4150.8 2603.8
## - Measles                      1      3.0 4152.0 2604.3
## - `Adult Mortality`           1      4.0 4153.0 2604.7
## - `Hepatitis B`               1      6.9 4155.9 2605.8
## - `Income composition of resources` 1      7.7 4156.6 2606.1
## - Alcohol                     1     12.8 4161.8 2608.2
## <none>                        4149.0 2610.5
## - `thinness 5-9 years`        1     22.4 4171.4 2611.9
## - `infant deaths`             1     29.4 4178.4 2614.7
## - `under-five deaths`         1     32.7 4181.7 2616.0
## - Schooling                   1     36.8 4185.8 2617.7
## - Year                        1    456.8 4605.8 2775.3
## - `HIV/AIDS`                  1    1026.4 5175.4 2967.6
## - Country                     132   16982.3 21131.3 4317.0
##
## Step:  AIC=2603.55
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##      `infant deaths` + Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##      `Total expenditure` + `HIV/AIDS` + GDP + `thinness 5-9 years` +
##      `Income composition of resources` + Schooling
##
##              Df Sum of Sq      RSS      AIC
## - GDP                          1      0.9 4151.0 2596.5
## - `Total expenditure`          1      1.9 4152.1 2596.9
## - Measles                      1      3.0 4153.2 2597.3
## - `Adult Mortality`           1      4.0 4154.1 2597.7
## - `Hepatitis B`               1      7.0 4157.2 2598.9
## - `Income composition of resources` 1      7.7 4157.8 2599.2
## - Alcohol                     1     12.5 4162.7 2601.1
## <none>                        4150.2 2603.5
## - `thinness 5-9 years`        1     22.3 4172.5 2605.0
## - `infant deaths`             1     29.1 4179.2 2607.7
## - `under-five deaths`         1     32.4 4182.5 2609.0
## - Schooling                   1     37.5 4187.6 2611.0
## - Year                        1    459.9 4610.1 2769.5
## - `HIV/AIDS`                  1    1025.3 5175.4 2960.2
## - Country                     132   17019.7 21169.8 4312.6
##
## Step:  AIC=2596.49
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##      `infant deaths` + Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##      `Total expenditure` + `HIV/AIDS` + `thinness 5-9 years` +
##      `Income composition of resources` + Schooling
##
##              Df Sum of Sq      RSS      AIC

```

```

## - `Total expenditure`      1      1.8  4152.9 2589.8
## - Measles                  1      3.0  4154.0 2590.3
## - `Adult Mortality`       1      3.9  4155.0 2590.6
## - `Hepatitis B`           1      6.9  4158.0 2591.8
## - `Income composition of resources` 1      7.5  4158.5 2592.0
## - Alcohol                  1     12.3  4163.3 2594.0
## <none>                     4151.0 2596.5
## - `thinness 5-9 years`     1     22.3  4173.4 2597.9
## - `infant deaths`          1     29.0  4180.0 2600.6
## - `under-five deaths`     1     32.3  4183.3 2601.9
## - Schooling                1     37.0  4188.0 2603.7
## - Year                     1    483.5  4634.5 2770.8
## - `HIV/AIDS`              1   1024.5  5175.5 2952.8
## - Country                  132  17885.0 22036.0 4371.4
##
## Step: AIC=2589.8
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##   `infant deaths` + Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##              Df Sum of Sq    RSS    AIC
## - Measles      1      2.9  4155.7 2583.5
## - `Adult Mortality` 1      3.9  4156.8 2584.0
## - `Hepatitis B`    1      6.7  4159.6 2585.1
## - `Income composition of resources` 1      7.6  4160.4 2585.4
## - Alcohol        1     12.2  4165.0 2587.2
## <none>           4152.9 2589.8
## - `thinness 5-9 years` 1     22.2  4175.1 2591.2
## - `infant deaths`    1     29.1  4181.9 2593.9
## - `under-five deaths` 1     32.4  4185.2 2595.2
## - Schooling        1     37.2  4190.0 2597.1
## - Year            1    481.7  4634.5 2763.3
## - `HIV/AIDS`       1   1022.7  5175.5 2945.4
## - Country          132  18014.7 22167.6 4373.8
##
## Step: AIC=2583.53
## life_expectancy_data$`Life expectancy` ~ Country + Year + `Adult Mortality` +
##   `infant deaths` + Alcohol + `Hepatitis B` + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##              Df Sum of Sq    RSS    AIC
## - `Adult Mortality` 1      3.9  4159.6 2577.7
## - `Hepatitis B`     1      6.8  4162.5 2578.8
## - `Income composition of resources` 1      7.5  4163.2 2579.1
## - Alcohol           1     12.2  4167.9 2581.0
## <none>              4155.7 2583.5
## - `thinness 5-9 years` 1     22.8  4178.5 2585.1
## - `infant deaths`     1     27.4  4183.2 2587.0
## - `under-five deaths` 1     31.0  4186.7 2588.4
## - Schooling          1     38.3  4194.0 2591.2

```

```

## - Year                1      482.8  4638.5 2757.4
## - `HIV/AIDS`         1      1021.8  5177.5 2938.6
## - Country            132     18052.6 22208.3 4369.4
##
## Step:  AIC=2577.67
## life_expectancy_data$`Life expectancy` ~ Country + Year + `infant deaths` +
##   Alcohol + `Hepatitis B` + `under-five deaths` + `HIV/AIDS` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##               Df Sum of Sq    RSS    AIC
## - `Hepatitis B`      1         6.6 4166.2 2572.9
## - `Income composition of resources` 1         7.7 4167.3 2573.3
## - Alcohol            1        12.3 4171.9 2575.1
## <none>                                4159.6 2577.7
## - `thinness 5-9 years` 1        22.9 4182.5 2579.3
## - `infant deaths`     1        27.4 4187.0 2581.1
## - `under-five deaths` 1        30.8 4190.4 2582.4
## - Schooling           1        38.6 4198.2 2585.5
## - Year                1       489.2 4648.8 2753.6
## - `HIV/AIDS`         1      1071.3 5230.9 2948.2
## - Country            132     22622.6 26782.2 4670.8
##
## Step:  AIC=2572.86
## life_expectancy_data$`Life expectancy` ~ Country + Year + `infant deaths` +
##   Alcohol + `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##               Df Sum of Sq    RSS    AIC
## - `Income composition of resources` 1         7.9 4174.1 2568.6
## - Alcohol            1        12.1 4178.3 2570.2
## <none>                                4166.2 2572.9
## - `thinness 5-9 years` 1        23.8 4190.0 2574.9
## - `infant deaths`     1        27.3 4193.5 2576.2
## - `under-five deaths` 1        31.2 4197.4 2577.8
## - Schooling           1        38.7 4204.8 2580.7
## - Year                1       515.0 4681.2 2757.7
## - `HIV/AIDS`         1      1076.3 5242.5 2944.4
## - Country            132     22626.1 26792.3 4664.0
##
## Step:  AIC=2568.59
## life_expectancy_data$`Life expectancy` ~ Country + Year + `infant deaths` +
##   Alcohol + `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   Schooling
##
##               Df Sum of Sq    RSS    AIC
## - Alcohol            1        11.5 4185.6 2565.7
## <none>                                4174.1 2568.6
## - `thinness 5-9 years` 1        24.1 4198.2 2570.7
## - `infant deaths`     1        27.3 4201.4 2571.9
## - `under-five deaths` 1        31.1 4205.2 2573.4
## - Schooling           1        38.5 4212.6 2576.3

```

```
## - Year          1      646.6  4820.7 2798.7
## - `HIV/AIDS`    1      1070.3  5244.4 2937.6
## - Country       132    26354.1 30528.2 4871.8
##
## Step:  AIC=2565.72
## life_expectancy_data$`Life expectancy` ~ Country + Year + `infant deaths` +
##      `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##      Schooling
##
##              Df Sum of Sq    RSS    AIC
## <none>                4185.6 2565.7
## - `thinness 5-9 years`  1      24.3  4209.9 2567.9
## - `infant deaths`      1      30.8  4216.4 2570.4
## - `under-five deaths`  1      34.4  4220.0 2571.8
## - Schooling            1      37.0  4222.6 2572.8
## - Year                 1      686.5  4872.1 2808.7
## - `HIV/AIDS`          1     1099.8  5285.4 2943.0
## - Country              132    26345.0 30530.7 4864.6
```

```
metrics_additive_mod_back_aic = calc_model_metrics(additive_mod_back_aic)
metrics_additive_mod_back_bic = calc_model_metrics(additive_mod_back_bic)
```

```
# AIC and BIC for models without highly correlated features
corr_mod_1_back_aic = step(corr_removed_model_1, direction = "backward")
```

```
## Start: AIC=1834.25
## `Life expectancy` ~ Country + Year + Status + `Adult Mortality` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
## Step: AIC=1834.25
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `percentage expenditure` + `Hepatitis B` + Measles + BMI +
##   `under-five deaths` + Polio + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
```

	Df	Sum of Sq	RSS	AIC
## - `thinness 1-19 years`	1	0.1	4176.1	1832.3
## - Polio	1	0.3	4176.4	1832.4
## - BMI	1	0.5	4176.6	1832.4
## - Diphtheria	1	0.7	4176.8	1832.5
## - `percentage expenditure`	1	0.8	4176.9	1832.6
## - Population	1	0.9	4176.9	1832.6
## - GDP	1	1.3	4177.3	1832.8
## - Measles	1	1.5	4177.6	1832.8
## - `Total expenditure`	1	2.0	4178.0	1833.0
## - `Adult Mortality`	1	4.0	4180.1	1833.8
## - `Hepatitis B`	1	4.2	4180.2	1833.9
## <none>			4176.1	1834.2
## - `under-five deaths`	1	6.8	4182.9	1834.9
## - `Income composition of resources`	1	7.5	4183.5	1835.2
## - `thinness 5-9 years`	1	12.3	4188.3	1837.1
## - Alcohol	1	16.6	4192.6	1838.8
## - Schooling	1	37.5	4213.6	1847.0
## - Year	1	453.5	4629.5	2002.2
## - `HIV/AIDS`	1	1047.7	5223.7	2201.4
## - Country	132	17387.2	21563.3	4277.3

```
##
## Step: AIC=1832.28
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `percentage expenditure` + `Hepatitis B` + Measles + BMI +
##   `under-five deaths` + Polio + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 5-9 years` + `Income composition of res
sources` +
##   Schooling
##
##
```

	Df	Sum of Sq	RSS	AIC
## - Polio	1	0.3	4176.4	1830.4
## - BMI	1	0.5	4176.6	1830.5
## - Diphtheria	1	0.7	4176.8	1830.6
## - `percentage expenditure`	1	0.8	4176.9	1830.6


```

## - Population          1      0.9  4177.1 1830.6
## - GDP                 1      1.3  4177.4 1830.8
## - Measles             1      1.5  4177.6 1830.9
## - `Total expenditure` 1      2.0  4178.1 1831.1
## - `Adult Mortality`   1      4.1  4180.2 1831.9
## - `Hepatitis B`       1      4.2  4180.3 1831.9
## <none>                4176.1 1832.3
## - `under-five deaths` 1      6.8  4182.9 1833.0
## - `Income composition of resources` 1      7.5  4183.6 1833.2
## - Alcohol             1     16.5  4192.7 1836.8
## - `thinness 5-9 years` 1     19.9  4196.0 1838.1
## - Schooling           1     37.5  4213.6 1845.0
## - Year                1    453.7  4629.8 2000.3
## - `HIV/AIDS`          1   1048.3  5224.4 2199.6
## - Country             132  17387.8 21563.9 4275.3
##
## Step:  AIC=1830.39
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `percentage expenditure` + `Hepatitis B` + Measles + BMI +
##   `under-five deaths` + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 5-9 years` + `Income composition of res
sources` +
##   Schooling
##
##              Df Sum of Sq    RSS    AIC
## - BMI          1      0.5  4176.9 1828.6
## - Diphtheria    1      0.5  4176.9 1828.6
## - `percentage expenditure` 1      0.8  4177.2 1828.7
## - Population    1      0.9  4177.3 1828.7
## - GDP           1      1.3  4177.7 1828.9
## - Measles       1      1.5  4177.9 1829.0
## - `Total expenditure` 1      2.0  4178.4 1829.2
## - `Hepatitis B` 1      4.0  4180.4 1830.0
## - `Adult Mortality` 1      4.0  4180.5 1830.0
## <none>          4176.4 1830.4
## - `under-five deaths` 1      6.8  4183.2 1831.1
## - `Income composition of resources` 1      7.5  4183.9 1831.3
## - Alcohol       1     16.5  4192.9 1834.9
## - `thinness 5-9 years` 1     19.8  4196.2 1836.2
## - Schooling     1     37.4  4213.8 1843.1
## - Year          1    453.9  4630.3 1998.5
## - `HIV/AIDS`    1   1048.2  5224.7 2197.7
## - Country       132  17414.4 21590.8 4275.4
##
## Step:  AIC=1828.58
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `percentage expenditure` + `Hepatitis B` + Measles + `under-five deaths` +
##   `Total expenditure` + Diphtheria + `HIV/AIDS` + GDP + Population +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##              Df Sum of Sq    RSS    AIC

```

```

## - Diphtheria 1 0.5 4177.4 1826.8
## - `percentage expenditure` 1 0.9 4177.8 1826.9
## - Population 1 0.9 4177.8 1826.9
## - GDP 1 1.4 4178.3 1827.1
## - Measles 1 1.6 4178.4 1827.2
## - `Total expenditure` 1 1.9 4178.8 1827.3
## - `Hepatitis B` 1 3.8 4180.7 1828.1
## - `Adult Mortality` 1 4.1 4180.9 1828.2
## <none> 4176.9 1828.6
## - `under-five deaths` 1 6.8 4183.7 1829.2
## - `Income composition of resources` 1 7.2 4184.1 1829.4
## - Alcohol 1 16.5 4193.4 1833.1
## - `thinness 5-9 years` 1 19.9 4196.8 1834.4
## - Schooling 1 37.4 4214.3 1841.3
## - Year 1 454.2 4631.1 1996.8
## - `HIV/AIDS` 1 1052.8 5229.6 2197.2
## - Country 132 17811.9 21988.8 4303.5
##
## Step: AIC=1826.79
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `percentage expenditure` + `Hepatitis B` + Measles + `under-five deaths` +
## `Total expenditure` + `HIV/AIDS` + GDP + Population + `thinness 5-9 years` +
## `Income composition of resources` + Schooling
##
## Df Sum of Sq RSS AIC
## - `percentage expenditure` 1 0.9 4178.3 1825.1
## - Population 1 1.0 4178.4 1825.2
## - GDP 1 1.3 4178.8 1825.3
## - Measles 1 1.5 4178.9 1825.4
## - `Total expenditure` 1 1.9 4179.3 1825.5
## - `Adult Mortality` 1 4.0 4181.4 1826.4
## <none> 4177.4 1826.8
## - `Hepatitis B` 1 6.8 4184.2 1827.5
## - `under-five deaths` 1 6.8 4184.3 1827.5
## - `Income composition of resources` 1 7.7 4185.1 1827.8
## - Alcohol 1 16.5 4193.9 1831.3
## - `thinness 5-9 years` 1 19.8 4197.3 1832.6
## - Schooling 1 37.7 4215.1 1839.6
## - Year 1 453.9 4631.3 1994.9
## - `HIV/AIDS` 1 1058.7 5236.1 2197.3
## - Country 132 17986.0 22163.4 4314.6
##
## Step: AIC=1825.13
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `Hepatitis B` + Measles + `under-five deaths` + `Total expenditure` +
## `HIV/AIDS` + GDP + Population + `thinness 5-9 years` + `Income composition of res
sources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - GDP 1 0.8 4179.1 1823.4
## - Population 1 1.0 4179.2 1823.5

```

```

## - Measles 1 1.5 4179.8 1823.7
## - `Total expenditure` 1 1.9 4180.2 1823.9
## - `Adult Mortality` 1 4.0 4182.2 1824.7
## <none> 4178.3 1825.1
## - `under-five deaths` 1 6.9 4185.2 1825.8
## - `Hepatitis B` 1 6.9 4185.2 1825.8
## - `Income composition of resources` 1 7.7 4186.0 1826.2
## - Alcohol 1 16.2 4194.5 1829.5
## - `thinness 5-9 years` 1 19.8 4198.1 1830.9
## - Schooling 1 38.3 4216.5 1838.2
## - Year 1 456.7 4635.0 1994.2
## - `HIV/AIDS` 1 1057.9 5236.1 2195.3
## - Country 132 18018.1 22196.4 4315.0
##
## Step: AIC=1823.44
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `Hepatitis B` + Measles + `under-five deaths` + `Total expenditure` +
## `HIV/AIDS` + Population + `thinness 5-9 years` + `Income composition of resources`
## +
## Schooling
##
## Df Sum of Sq RSS AIC
## - Population 1 1.0 4180.0 1821.8
## - Measles 1 1.5 4180.6 1822.0
## - `Total expenditure` 1 1.9 4181.0 1822.2
## - `Adult Mortality` 1 3.9 4183.0 1823.0
## <none> 4179.1 1823.4
## - `Hepatitis B` 1 6.8 4185.9 1824.1
## - `under-five deaths` 1 6.8 4185.9 1824.1
## - `Income composition of resources` 1 7.5 4186.6 1824.4
## - Alcohol 1 16.0 4195.1 1827.7
## - `thinness 5-9 years` 1 19.8 4198.9 1829.2
## - Schooling 1 37.8 4216.8 1836.3
## - Year 1 479.7 4658.7 2000.6
## - `HIV/AIDS` 1 1057.2 5236.3 2193.3
## - Country 132 18877.3 23056.3 4375.7
##
## Step: AIC=1821.82
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `Hepatitis B` + Measles + `under-five deaths` + `Total expenditure` +
## `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - Measles 1 1.3 4181.3 1820.3
## - `Total expenditure` 1 1.9 4181.9 1820.6
## - `Adult Mortality` 1 3.8 4183.9 1821.3
## <none> 4180.0 1821.8
## - `under-five deaths` 1 5.9 4185.9 1822.1
## - `Hepatitis B` 1 6.9 4187.0 1822.5
## - `Income composition of resources` 1 7.5 4187.5 1822.8
## - Alcohol 1 16.0 4196.0 1826.1

```

```

## - `thinness 5-9 years`      1      19.4  4199.4 1827.4
## - Schooling                1      38.2  4218.3 1834.8
## - Year                    1     481.2  4661.3 1999.5
## - `HIV/AIDS`              1    1057.0  5237.0 2191.6
## - Country                 132   18943.2 23123.2 4378.5
##
## Step:  AIC=1820.34
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `Hepatitis B` + `under-five deaths` + `Total expenditure` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##              Df Sum of Sq    RSS    AIC
## - `Total expenditure`      1      1.8  4183.2 1819.0
## - `Adult Mortality`        1      3.8  4185.1 1819.8
## <none>                      4181.3 1820.3
## - `under-five deaths`      1      6.9  4188.3 1821.1
## - `Hepatitis B`            1      7.0  4188.3 1821.1
## - `Income composition of resources` 1      7.4  4188.8 1821.3
## - Alcohol                  1     16.0  4197.3 1824.6
## - `thinness 5-9 years`     1     19.8  4201.2 1826.1
## - Schooling                1     39.0  4220.3 1833.6
## - Year                    1    482.0  4663.3 1998.2
## - `HIV/AIDS`              1   1056.0  5237.3 2189.6
## - Country                 132  18949.3 23130.6 4377.0
##
## Step:  AIC=1819.05
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `Hepatitis B` + `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##              Df Sum of Sq    RSS    AIC
## - `Adult Mortality`        1      3.8  4187.0 1818.6
## <none>                      4183.2 1819.0
## - `Hepatitis B`            1      6.7  4189.9 1819.7
## - `under-five deaths`      1      6.9  4190.1 1819.8
## - `Income composition of resources` 1      7.5  4190.7 1820.0
## - Alcohol                  1     15.8  4199.0 1823.3
## - `thinness 5-9 years`     1     19.7  4202.9 1824.8
## - Schooling                1     39.2  4222.3 1832.4
## - Year                    1    480.2  4663.3 1996.2
## - `HIV/AIDS`              1   1054.2  5237.3 2187.7
## - Country                 132  19069.7 23252.8 4383.7
##
## Step:  AIC=1818.55
## `Life expectancy` ~ Country + Year + Alcohol + `Hepatitis B` +
##   `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##              Df Sum of Sq    RSS    AIC
## <none>                      4187.0 1818.6
## - `Hepatitis B`            1      6.5  4193.5 1819.1

```

```
## - `under-five deaths`      1      6.6  4193.6 1819.1
## - `Income composition of resources` 1      7.7  4194.7 1819.6
## - Alcohol                  1     15.9  4202.9 1822.8
## - `thinness 5-9 years`     1     19.8  4206.8 1824.4
## - Schooling                1     39.5  4226.5 1832.1
## - Year                     1    486.6  4673.5 1997.8
## - `HIV/AIDS`              1    1104.8  5291.8 2202.7
## - Country                  132   24235.1 28422.1 4712.7
```

```
corr_mod_2_back_aic = step(corr_removed_model_2, direction = "backward")
```

```
## Start: AIC=1837.09
## `Life expectancy` ~ Country + Year + Status + `Adult Mortality` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `Income composition of resources` + Schooling
##
##
## Step: AIC=1837.09
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `percentage expenditure` + `Hepatitis B` + Measles + BMI +
##   `under-five deaths` + Polio + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `Income composition of resources` + Schooling
##
##
```

	Df	Sum of Sq	RSS	AIC
## - Polio	1	0.4	4188.7	1835.3
## - Population	1	0.5	4188.8	1835.3
## - BMI	1	0.6	4189.0	1835.3
## - `percentage expenditure`	1	0.7	4189.1	1835.4
## - Diphtheria	1	0.7	4189.1	1835.4
## - GDP	1	1.2	4189.5	1835.6
## - Measles	1	1.8	4190.2	1835.8
## - `Total expenditure`	1	1.9	4190.3	1835.8
## - `Adult Mortality`	1	3.9	4192.3	1836.6
## - `Hepatitis B`	1	4.5	4192.8	1836.9
## <none>			4188.3	1837.1
## - `under-five deaths`	1	6.6	4194.9	1837.7
## - `Income composition of resources`	1	7.7	4196.0	1838.1
## - `thinness 1-19 years`	1	7.7	4196.0	1838.1
## - Alcohol	1	17.0	4205.4	1841.8
## - Schooling	1	38.2	4226.5	1850.1
## - Year	1	448.0	4636.3	2002.6
## - `HIV/AIDS`	1	1036.4	5224.8	2199.7
## - Country	132	17376.8	21565.1	4275.4

```
##
## Step: AIC=1835.25
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `percentage expenditure` + `Hepatitis B` + Measles + BMI +
##   `under-five deaths` + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `Income composition of resources` + Schooling
##
##
```

	Df	Sum of Sq	RSS	AIC
## - Diphtheria	1	0.5	4189.2	1833.4
## - Population	1	0.5	4189.3	1833.5
## - BMI	1	0.6	4189.4	1833.5
## - `percentage expenditure`	1	0.7	4189.5	1833.5
## - GDP	1	1.2	4189.9	1833.7
## - Measles	1	1.8	4190.6	1834.0
## - `Total expenditure`	1	2.0	4190.7	1834.0
## - `Adult Mortality`	1	3.9	4192.7	1834.8

```

## - `Hepatitis B` 1 4.2 4193.0 1834.9
## <none> 4188.7 1835.3
## - `under-five deaths` 1 6.5 4195.3 1835.8
## - `thinness 1-19 years` 1 7.4 4196.2 1836.2
## - `Income composition of resources` 1 7.7 4196.4 1836.3
## - Alcohol 1 17.0 4205.7 1839.9
## - Schooling 1 38.1 4226.8 1848.2
## - Year 1 448.0 4636.8 2000.8
## - `HIV/AIDS` 1 1036.2 5225.0 2197.8
## - Country 132 17404.2 21593.0 4275.6
##
## Step: AIC=1833.44
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `percentage expenditure` + `Hepatitis B` + Measles + BMI +
## `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + Population + `thinness 1-19 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - Population 1 0.5 4189.8 1831.7
## - BMI 1 0.6 4189.9 1831.7
## - `percentage expenditure` 1 0.7 4189.9 1831.7
## - GDP 1 1.2 4190.4 1831.9
## - Measles 1 1.8 4191.1 1832.2
## - `Total expenditure` 1 1.9 4191.2 1832.2
## - `Adult Mortality` 1 3.9 4193.1 1833.0
## <none> 4189.2 1833.4
## - `under-five deaths` 1 6.6 4195.8 1834.0
## - `Hepatitis B` 1 7.3 4196.6 1834.3
## - `thinness 1-19 years` 1 7.4 4196.6 1834.3
## - `Income composition of resources` 1 8.1 4197.3 1834.6
## - Alcohol 1 17.0 4206.2 1838.1
## - Schooling 1 38.4 4227.6 1846.5
## - Year 1 447.7 4636.9 1998.9
## - `HIV/AIDS` 1 1041.7 5230.9 2197.6
## - Country 132 17615.7 21804.9 4289.7
##
## Step: AIC=1831.66
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `percentage expenditure` + `Hepatitis B` + Measles + BMI +
## `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + `thinness 1-19 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - BMI 1 0.7 4190.4 1829.9
## - `percentage expenditure` 1 0.7 4190.5 1829.9
## - GDP 1 1.1 4190.9 1830.1
## - Measles 1 1.6 4191.4 1830.3
## - `Total expenditure` 1 2.0 4191.7 1830.4
## - `Adult Mortality` 1 3.8 4193.6 1831.2
## <none> 4189.8 1831.7

```

```

## - `under-five deaths` 1 6.0 4195.8 1832.0
## - `thinness 1-19 years` 1 7.3 4197.1 1832.5
## - `Hepatitis B` 1 7.4 4197.2 1832.6
## - `Income composition of resources` 1 8.1 4197.8 1832.8
## - Alcohol 1 17.0 4206.8 1836.3
## - Schooling 1 38.7 4228.5 1844.8
## - Year 1 449.1 4638.9 1997.6
## - `HIV/AIDS` 1 1041.8 5231.6 2195.8
## - Country 132 17666.8 21856.6 4291.6
##
## Step: AIC=1829.91
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `percentage expenditure` + `Hepatitis B` + Measles + `under-five deaths` +
## `Total expenditure` + `HIV/AIDS` + GDP + `thinness 1-19 years` +
## `Income composition of resources` + Schooling
##
## Df Sum of Sq RSS AIC
## - `percentage expenditure` 1 0.8 4191.2 1828.2
## - GDP 1 1.3 4191.7 1828.4
## - Measles 1 1.7 4192.1 1828.6
## - `Total expenditure` 1 1.8 4192.3 1828.6
## - `Adult Mortality` 1 3.8 4194.2 1829.4
## <none> 4190.4 1829.9
## - `under-five deaths` 1 6.0 4196.5 1830.3
## - `Hepatitis B` 1 7.2 4197.7 1830.8
## - `thinness 1-19 years` 1 7.4 4197.8 1830.8
## - `Income composition of resources` 1 7.8 4198.2 1831.0
## - Alcohol 1 17.0 4207.4 1834.6
## - Schooling 1 38.8 4229.2 1843.1
## - Year 1 449.2 4639.6 1995.8
## - `HIV/AIDS` 1 1046.6 5237.0 2195.6
## - Country 132 18049.9 22240.3 4318.3
##
## Step: AIC=1828.23
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `Hepatitis B` + Measles + `under-five deaths` + `Total expenditure` +
## `HIV/AIDS` + GDP + `thinness 1-19 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - GDP 1 0.8 4192.0 1826.5
## - Measles 1 1.7 4192.9 1826.9
## - `Total expenditure` 1 1.9 4193.1 1827.0
## - `Adult Mortality` 1 3.8 4195.0 1827.7
## <none> 4191.2 1828.2
## - `under-five deaths` 1 6.1 4197.3 1828.6
## - `Hepatitis B` 1 7.3 4198.5 1829.1
## - `thinness 1-19 years` 1 7.4 4198.6 1829.1
## - `Income composition of resources` 1 7.8 4199.0 1829.3
## - Alcohol 1 16.7 4207.9 1832.8
## - Schooling 1 39.3 4230.5 1841.6
## - Year 1 452.0 4643.2 1995.1

```



```

## - `HIV/AIDS` 1 1045.8 5237.0 2193.6
## - Country 132 18083.2 22274.4 4318.8
##
## Step: AIC=1826.53
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `Hepatitis B` + Measles + `under-five deaths` + `Total expenditure` +
## `HIV/AIDS` + `thinness 1-19 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - Measles 1 1.7 4193.7 1825.2
## - `Total expenditure` 1 1.8 4193.8 1825.3
## - `Adult Mortality` 1 3.8 4195.8 1826.0
## <none> 4192.0 1826.5
## - `under-five deaths` 1 6.1 4198.1 1826.9
## - `Hepatitis B` 1 7.2 4199.2 1827.4
## - `thinness 1-19 years` 1 7.4 4199.4 1827.4
## - `Income composition of resources` 1 7.6 4199.6 1827.5
## - Alcohol 1 16.5 4208.5 1831.0
## - Schooling 1 38.8 4230.8 1839.7
## - Year 1 474.9 4666.9 2001.5
## - `HIV/AIDS` 1 1045.2 5237.2 2191.6
## - Country 132 18953.6 23145.6 4380.1
##
## Step: AIC=1825.2
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `Hepatitis B` + `under-five deaths` + `Total expenditure` +
## `HIV/AIDS` + `thinness 1-19 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - `Total expenditure` 1 1.7 4195.4 1823.9
## - `Adult Mortality` 1 3.7 4197.4 1824.7
## <none> 4193.7 1825.2
## - `under-five deaths` 1 7.2 4200.9 1826.0
## - `Hepatitis B` 1 7.3 4201.0 1826.1
## - `thinness 1-19 years` 1 7.5 4201.2 1826.1
## - `Income composition of resources` 1 7.6 4201.3 1826.2
## - Alcohol 1 16.4 4210.1 1829.6
## - Schooling 1 39.7 4233.4 1838.7
## - Year 1 475.5 4669.2 2000.3
## - `HIV/AIDS` 1 1043.8 5237.5 2189.7
## - Country 132 18960.2 23153.9 4378.6
##
## Step: AIC=1823.88
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `Hepatitis B` + `under-five deaths` + `HIV/AIDS` + `thinness 1-19 years` +
## `Income composition of resources` + Schooling
##
## Df Sum of Sq RSS AIC
## - `Adult Mortality` 1 3.7 4199.2 1823.3
## <none> 4195.4 1823.9

```

```
## - `Hepatitis B` 1 7.1 4202.5 1824.6
## - `under-five deaths` 1 7.2 4202.6 1824.7
## - `thinness 1-19 years` 1 7.4 4202.9 1824.8
## - `Income composition of resources` 1 7.7 4203.1 1824.9
## - Alcohol 1 16.3 4211.7 1828.3
## - Schooling 1 39.8 4235.3 1837.5
## - Year 1 473.8 4669.2 1998.3
## - `HIV/AIDS` 1 1042.1 5237.5 2187.7
## - Country 132 19087.0 23282.4 4385.8
##
## Step: AIC=1823.34
## `Life expectancy` ~ Country + Year + Alcohol + `Hepatitis B` +
## `under-five deaths` + `HIV/AIDS` + `thinness 1-19 years` +
## `Income composition of resources` + Schooling
##
## Df Sum of Sq RSS AIC
## <none> 4199.2 1823.3
## - `Hepatitis B` 1 6.8 4206.0 1824.0
## - `under-five deaths` 1 6.9 4206.0 1824.0
## - `thinness 1-19 years` 1 7.7 4206.8 1824.4
## - `Income composition of resources` 1 7.9 4207.0 1824.4
## - Alcohol 1 16.4 4215.5 1827.8
## - Schooling 1 40.2 4239.4 1837.1
## - Year 1 480.2 4679.3 1999.9
## - `HIV/AIDS` 1 1092.7 5291.9 2202.7
## - Country 132 24329.7 28528.8 4718.9
```

```
corr_mod_3_back_aic = step(corr_removed_model_3, direction = "backward")
```

```
## Start: AIC=1824.98
## `Life expectancy` ~ Country + Year + Status + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
## Step: AIC=1824.98
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
##           Df Sum of Sq    RSS    AIC
## - Polio      1      0.1 4147.8 1823.0
## - Diphtheria  1      0.2 4147.9 1823.1
## - Population  1      0.3 4147.9 1823.1
## - `thinness 1-19 years`  1      0.3 4148.0 1823.1
## - BMI         1      0.5 4148.1 1823.2
## - `percentage expenditure`  1      1.1 4148.7 1823.4
## - GDP         1      1.6 4149.3 1823.6
## - `Total expenditure`  1      1.9 4149.6 1823.7
## - Measles     1      2.8 4150.5 1824.1
## - `Adult Mortality`  1      3.9 4151.6 1824.5
## - `Hepatitis B`  1      4.8 4152.4 1824.9
## <none>                                4147.6 1825.0
## - `Income composition of resources`  1      7.6 4155.2 1826.0
## - `thinness 5-9 years`  1     12.5 4160.1 1827.9
## - Alcohol     1     12.8 4160.4 1828.1
## - `infant deaths`  1     28.4 4176.1 1834.2
## - `under-five deaths`  1     32.1 4179.7 1835.7
## - Schooling   1     37.0 4184.6 1837.6
## - Year        1    456.5 4604.1 1995.2
## - `HIV/AIDS`  1   1016.8 5164.4 2184.5
## - Country    132  16527.0 20674.7 4209.9
##
## Step: AIC=1823.04
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
##           Df Sum of Sq    RSS    AIC
## - Diphtheria  1      0.2 4147.9 1821.1
## - Population  1      0.3 4148.0 1821.2
## - `thinness 1-19 years`  1      0.3 4148.1 1821.2
```

```

## - BMI 1 0.5 4148.3 1821.2
## - `percentage expenditure` 1 1.1 4148.8 1821.5
## - GDP 1 1.6 4149.4 1821.7
## - `Total expenditure` 1 2.0 4149.7 1821.8
## - Measles 1 2.9 4150.6 1822.2
## - `Adult Mortality` 1 3.9 4151.7 1822.6
## - `Hepatitis B` 1 4.7 4152.4 1822.9
## <none> 4147.8 1823.0
## - `Income composition of resources` 1 7.6 4155.4 1824.1
## - `thinness 5-9 years` 1 12.6 4160.3 1826.0
## - Alcohol 1 12.8 4160.5 1826.1
## - `infant deaths` 1 28.6 4176.4 1832.4
## - `under-five deaths` 1 32.2 4180.0 1833.8
## - Schooling 1 36.9 4184.7 1835.6
## - Year 1 456.6 4604.4 1993.2
## - `HIV/AIDS` 1 1016.7 5164.4 2182.5
## - Country 132 16542.4 20690.1 4209.1
##
## Step: AIC=1821.1
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
## BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + Population + `thinness 1-19 years` + `thinness 5-9 years` +
## `Income composition of resources` + Schooling
##
## Df Sum of Sq RSS AIC
## - Population 1 0.3 4148.2 1819.2
## - `thinness 1-19 years` 1 0.3 4148.2 1819.2
## - BMI 1 0.5 4148.4 1819.3
## - `percentage expenditure` 1 1.1 4149.0 1819.5
## - GDP 1 1.6 4149.5 1819.7
## - `Total expenditure` 1 2.0 4149.9 1819.9
## - Measles 1 2.8 4150.8 1820.2
## - `Adult Mortality` 1 3.9 4151.8 1820.7
## <none> 4147.9 1821.1
## - `Hepatitis B` 1 7.1 4155.0 1821.9
## - `Income composition of resources` 1 7.9 4155.8 1822.2
## - `thinness 5-9 years` 1 12.6 4160.5 1824.1
## - Alcohol 1 12.8 4160.7 1824.2
## - `infant deaths` 1 28.9 4176.9 1830.6
## - `under-five deaths` 1 32.6 4180.5 1832.0
## - Schooling 1 37.1 4185.0 1833.8
## - Year 1 456.9 4604.9 1991.4
## - `HIV/AIDS` 1 1020.4 5168.3 2181.8
## - Country 132 16656.3 20804.2 4216.2
##
## Step: AIC=1819.21
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
## BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + `thinness 1-19 years` + `thinness 5-9 years` + `Income composition of resources` +

```

```

##      Schooling
##
##                                     Df Sum of Sq      RSS      AIC
## - `thinness 1-19 years`          1         0.3  4148.5  1817.3
## - BMI                            1         0.5  4148.7  1817.4
## - `percentage expenditure`       1         1.1  4149.3  1817.6
## - GDP                            1         1.6  4149.8  1817.9
## - `Total expenditure`           1         1.9  4150.1  1818.0
## - Measles                        1         3.0  4151.2  1818.4
## - `Adult Mortality`             1         4.0  4152.2  1818.8
## <none>                           4148.2  1819.2
## - `Hepatitis B`                 1         7.0  4155.2  1820.0
## - `Income composition of resources` 1         7.9  4156.1  1820.4
## - Alcohol                       1        12.9  4161.1  1822.3
## - `thinness 5-9 years`          1        12.9  4161.1  1822.3
## - `infant deaths`              1        29.6  4177.8  1828.9
## - `under-five deaths`          1        32.9  4181.1  1830.2
## - Schooling                     1        36.9  4185.1  1831.8
## - Year                          1       456.7  4604.9  1989.4
## - `HIV/AIDS`                   1      1021.7  5169.9  2180.3
## - Country                       132    16656.9 20805.1  4214.3
##
## Step:  AIC=1817.32
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##                                     Df Sum of Sq      RSS      AIC
## - BMI                            1         0.5  4149.0  1815.5
## - `percentage expenditure`       1         1.1  4149.5  1815.7
## - GDP                            1         1.6  4150.1  1816.0
## - `Total expenditure`           1         1.9  4150.4  1816.1
## - Measles                        1         2.9  4151.4  1816.5
## - `Adult Mortality`             1         4.0  4152.5  1816.9
## <none>                           4148.5  1817.3
## - `Hepatitis B`                 1         7.1  4155.6  1818.1
## - `Income composition of resources` 1         7.9  4156.4  1818.5
## - Alcohol                       1        12.8  4161.3  1820.4
## - `thinness 5-9 years`          1        22.2  4170.7  1824.1
## - `infant deaths`              1        29.4  4177.9  1827.0
## - `under-five deaths`          1        32.7  4181.2  1828.3
## - Schooling                     1        36.8  4185.3  1829.9
## - Year                          1       456.5  4605.0  1987.5
## - `HIV/AIDS`                   1      1021.7  5170.1  2178.4
## - Country                       132    16656.6 20805.1  4212.3
##
## Step:  AIC=1815.52
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   `under-five deaths` + `Total expenditure` + `HIV/AIDS` +

```

```

##      GDP + `thinness 5-9 years` + `Income composition of resources` +
##      Schooling
##
##              Df Sum of Sq      RSS      AIC
## - `percentage expenditure`      1      1.2  4150.2  1814.0
## - GDP                          1      1.7  4150.7  1814.2
## - `Total expenditure`          1      1.8  4150.8  1814.3
## - Measles                      1      3.0  4152.0  1814.7
## - `Adult Mortality`           1      4.0  4153.0  1815.1
## <none>                          4149.0  1815.5
## - `Hepatitis B`                1      6.9  4155.9  1816.3
## - `Income composition of resources` 1      7.7  4156.6  1816.6
## - Alcohol                     1     12.8  4161.8  1818.6
## - `thinness 5-9 years`         1     22.4  4171.4  1822.4
## - `infant deaths`              1     29.4  4178.4  1825.2
## - `under-five deaths`          1     32.7  4181.7  1826.5
## - Schooling                    1     36.8  4185.8  1828.1
## - Year                        1    456.8  4605.8  1985.8
## - `HIV/AIDS`                  1   1026.4  5175.4  2178.0
## - Country                     132  16982.3 21131.3  4235.9
##
## Step:  AIC=1813.99
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##      Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##      `Total expenditure` + `HIV/AIDS` + GDP + `thinness 5-9 years` +
##      `Income composition of resources` + Schooling
##
##              Df Sum of Sq      RSS      AIC
## - GDP                          1      0.9  4151.0  1812.3
## - `Total expenditure`          1      1.9  4152.1  1812.7
## - Measles                      1      3.0  4153.2  1813.2
## - `Adult Mortality`           1      4.0  4154.1  1813.6
## <none>                          4150.2  1814.0
## - `Hepatitis B`                1      7.0  4157.2  1814.8
## - `Income composition of resources` 1      7.7  4157.8  1815.0
## - Alcohol                     1     12.5  4162.7  1817.0
## - `thinness 5-9 years`         1     22.3  4172.5  1820.8
## - `infant deaths`              1     29.1  4179.2  1823.5
## - `under-five deaths`          1     32.4  4182.5  1824.8
## - Schooling                    1     37.5  4187.6  1826.8
## - Year                        1    459.9  4610.1  1985.3
## - `HIV/AIDS`                  1   1025.3  5175.4  2176.0
## - Country                     132  17019.7 21169.8  4236.9
##
## Step:  AIC=1812.34
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##      Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##      `Total expenditure` + `HIV/AIDS` + `thinness 5-9 years` +
##      `Income composition of resources` + Schooling
##
##              Df Sum of Sq      RSS      AIC
## - `Total expenditure`          1      1.8  4152.9  1811.1

```

```

## - Measles 1 3.0 4154.0 1811.5
## - `Adult Mortality` 1 3.9 4155.0 1811.9
## <none> 4151.0 1812.3
## - `Hepatitis B` 1 6.9 4158.0 1813.1
## - `Income composition of resources` 1 7.5 4158.5 1813.3
## - Alcohol 1 12.3 4163.3 1815.2
## - `thinness 5-9 years` 1 22.3 4173.4 1819.2
## - `infant deaths` 1 29.0 4180.0 1821.8
## - `under-five deaths` 1 32.3 4183.3 1823.1
## - Schooling 1 37.0 4188.0 1825.0
## - Year 1 483.5 4634.5 1992.0
## - `HIV/AIDS` 1 1024.5 5175.5 2174.1
## - Country 132 17885.0 22036.0 4301.0
##
## Step: AIC=1811.06
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
## `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - Measles 1 2.9 4155.7 1810.2
## - `Adult Mortality` 1 3.9 4156.8 1810.6
## <none> 4152.9 1811.1
## - `Hepatitis B` 1 6.7 4159.6 1811.7
## - `Income composition of resources` 1 7.6 4160.4 1812.1
## - Alcohol 1 12.2 4165.0 1813.9
## - `thinness 5-9 years` 1 22.2 4175.1 1817.9
## - `infant deaths` 1 29.1 4181.9 1820.6
## - `under-five deaths` 1 32.4 4185.2 1821.9
## - Schooling 1 37.2 4190.0 1823.8
## - Year 1 481.7 4634.5 1990.0
## - `HIV/AIDS` 1 1022.7 5175.5 2172.1
## - Country 132 18014.7 22167.6 4308.9
##
## Step: AIC=1810.2
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `Hepatitis B` + `under-five deaths` + `HIV/AIDS` +
## `thinness 5-9 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - `Adult Mortality` 1 3.9 4159.6 1809.7
## <none> 4155.7 1810.2
## - `Hepatitis B` 1 6.8 4162.5 1810.9
## - `Income composition of resources` 1 7.5 4163.2 1811.2
## - Alcohol 1 12.2 4167.9 1813.0
## - `thinness 5-9 years` 1 22.8 4178.5 1817.2
## - `infant deaths` 1 27.4 4183.2 1819.0
## - `under-five deaths` 1 31.0 4186.7 1820.4
## - Schooling 1 38.3 4194.0 1823.3
## - Year 1 482.8 4638.5 1989.4

```

```
## - `HIV/AIDS`          1      1021.8  5177.5 2170.7
## - Country              132     18052.6 22208.3 4309.9
##
## Step: AIC=1809.74
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `Hepatitis B` + `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##               Df Sum of Sq      RSS      AIC
## <none>                        4159.6 1809.7
## - `Hepatitis B`              1         6.6 4166.2 1810.3
## - `Income composition of resources` 1         7.7 4167.3 1810.8
## - Alcohol                   1        12.3 4171.9 1812.6
## - `thinness 5-9 years`      1        22.9 4182.5 1816.8
## - `infant deaths`          1        27.4 4187.0 1818.6
## - `under-five deaths`      1        30.8 4190.4 1819.9
## - Schooling                 1        38.6 4198.2 1823.0
## - Year                      1       489.2 4648.8 1991.1
## - `HIV/AIDS`               1       1071.3 5230.9 2185.6
## - Country                   132     22622.6 26782.2 4616.7
```

```
corr_mod_1_back_bic = step(corr_removed_model_1, direction = "backward", k = log(n))
```



```
## Start: AIC=2650.84
## `Life expectancy` ~ Country + Year + Status + `Adult Mortality` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
## Step: AIC=2650.84
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `percentage expenditure` + `Hepatitis B` + Measles + BMI +
##   `under-five deaths` + Polio + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
##           Df Sum of Sq    RSS    AIC
## - `thinness 1-19 years`      1      0.1  4176.1 2643.5
## - Polio                      1      0.3  4176.4 2643.6
## - BMI                        1      0.5  4176.6 2643.6
## - Diphtheria                 1      0.7  4176.8 2643.7
## - `percentage expenditure`   1      0.8  4176.9 2643.8
## - Population                 1      0.9  4176.9 2643.8
## - GDP                       1      1.3  4177.3 2643.9
## - Measles                    1      1.5  4177.6 2644.0
## - `Total expenditure`       1      2.0  4178.0 2644.2
## - `Adult Mortality`         1      4.0  4180.1 2645.0
## - `Hepatitis B`             1      4.2  4180.2 2645.1
## - `under-five deaths`       1      6.8  4182.9 2646.1
## - `Income composition of resources` 1      7.5  4183.5 2646.4
## - `thinness 5-9 years`      1     12.3  4188.3 2648.3
## - Alcohol                   1     16.6  4192.6 2650.0
## <none>                      4176.1 2650.8
## - Schooling                  1     37.5  4213.6 2658.2
## - Year                       1    453.5  4629.5 2813.4
## - `HIV/AIDS`                1   1047.7  5223.7 3012.6
## - Country                   132  17387.2 21563.3 4380.0
##
## Step: AIC=2643.47
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `percentage expenditure` + `Hepatitis B` + Measles + BMI +
##   `under-five deaths` + Polio + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 5-9 years` + `Income composition of res
sources` +
##   Schooling
##
##
##           Df Sum of Sq    RSS    AIC
## - Polio                      1      0.3  4176.4 2636.2
## - BMI                        1      0.5  4176.6 2636.3
## - Diphtheria                 1      0.7  4176.8 2636.3
## - `percentage expenditure`   1      0.8  4176.9 2636.4
```

```

## - Population 1 0.9 4177.1 2636.4
## - GDP 1 1.3 4177.4 2636.6
## - Measles 1 1.5 4177.6 2636.7
## - `Total expenditure` 1 2.0 4178.1 2636.8
## - `Adult Mortality` 1 4.1 4180.2 2637.7
## - `Hepatitis B` 1 4.2 4180.3 2637.7
## - `under-five deaths` 1 6.8 4182.9 2638.7
## - `Income composition of resources` 1 7.5 4183.6 2639.0
## - Alcohol 1 16.5 4192.7 2642.6
## <none> 4176.1 2643.5
## - `thinness 5-9 years` 1 19.9 4196.0 2643.9
## - Schooling 1 37.5 4213.6 2650.8
## - Year 1 453.7 4629.8 2806.1
## - `HIV/AIDS` 1 1048.3 5224.4 3005.4
## - Country 132 17387.8 21563.9 4372.7
##
## Step: AIC=2636.17
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `percentage expenditure` + `Hepatitis B` + Measles + BMI +
## `under-five deaths` + `Total expenditure` + Diphtheria +
## `HIV/AIDS` + GDP + Population + `thinness 5-9 years` + `Income composition of res
sources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - BMI 1 0.5 4176.9 2629.0
## - Diphtheria 1 0.5 4176.9 2629.0
## - `percentage expenditure` 1 0.8 4177.2 2629.1
## - Population 1 0.9 4177.3 2629.1
## - GDP 1 1.3 4177.7 2629.3
## - Measles 1 1.5 4177.9 2629.4
## - `Total expenditure` 1 2.0 4178.4 2629.6
## - `Hepatitis B` 1 4.0 4180.4 2630.3
## - `Adult Mortality` 1 4.0 4180.5 2630.4
## - `under-five deaths` 1 6.8 4183.2 2631.4
## - `Income composition of resources` 1 7.5 4183.9 2631.7
## - Alcohol 1 16.5 4192.9 2635.3
## <none> 4176.4 2636.2
## - `thinness 5-9 years` 1 19.8 4196.2 2636.6
## - Schooling 1 37.4 4213.8 2643.4
## - Year 1 453.9 4630.3 2798.9
## - `HIV/AIDS` 1 1048.2 5224.7 2998.0
## - Country 132 17414.4 21590.8 4367.3
##
## Step: AIC=2628.95
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `percentage expenditure` + `Hepatitis B` + Measles + `under-five deaths` +
## `Total expenditure` + Diphtheria + `HIV/AIDS` + GDP + Population +
## `thinness 5-9 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC

```

```

## - Diphtheria                1          0.5  4177.4 2621.8
## - `percentage expenditure`   1          0.9  4177.8 2621.9
## - Population                 1          0.9  4177.8 2621.9
## - GDP                       1          1.4  4178.3 2622.1
## - Measles                   1          1.6  4178.4 2622.2
## - `Total expenditure`       1          1.9  4178.8 2622.3
## - `Hepatitis B`             1          3.8  4180.7 2623.1
## - `Adult Mortality`        1          4.1  4180.9 2623.1
## - `under-five deaths`      1          6.8  4183.7 2624.2
## - `Income composition of resources` 1          7.2  4184.1 2624.4
## - Alcohol                   1         16.5  4193.4 2628.0
## <none>                      4176.9 2629.0
## - `thinness 5-9 years`     1         19.9  4196.8 2629.4
## - Schooling                 1         37.4  4214.3 2636.2
## - Year                      1        454.2  4631.1 2791.8
## - `HIV/AIDS`               1       1052.8  5229.6 2992.2
## - Country                   132     17811.9 21988.8 4390.0
##
## Step: AIC=2621.75
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `percentage expenditure` + `Hepatitis B` + Measles + `under-five deaths` +
##   `Total expenditure` + `HIV/AIDS` + GDP + Population + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##               Df Sum of Sq    RSS    AIC
## - `percentage expenditure`   1         0.9  4178.3 2614.7
## - Population                 1         1.0  4178.4 2614.7
## - GDP                       1         1.3  4178.8 2614.9
## - Measles                   1         1.5  4178.9 2614.9
## - `Total expenditure`       1         1.9  4179.3 2615.1
## - `Adult Mortality`        1         4.0  4181.4 2615.9
## - `Hepatitis B`             1         6.8  4184.2 2617.0
## - `under-five deaths`      1         6.8  4184.3 2617.0
## - `Income composition of resources` 1         7.7  4185.1 2617.4
## - Alcohol                   1        16.5  4193.9 2620.9
## <none>                      4177.4 2621.8
## - `thinness 5-9 years`     1        19.8  4197.3 2622.2
## - Schooling                 1        37.7  4215.1 2629.2
## - Year                      1       453.9  4631.3 2784.4
## - `HIV/AIDS`               1      1058.7  5236.1 2986.8
## - Country                   132    17986.0 22163.4 4395.7
##
## Step: AIC=2614.68
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `Hepatitis B` + Measles + `under-five deaths` + `Total expenditure` +
##   `HIV/AIDS` + GDP + Population + `thinness 5-9 years` + `Income composition of res
sources` +
##   Schooling
##
##               Df Sum of Sq    RSS    AIC
## - GDP               1         0.8  4179.1 2607.6
## - Population        1         1.0  4179.2 2607.7

```

```

## - Measles 1 1.5 4179.8 2607.9
## - `Total expenditure` 1 1.9 4180.2 2608.0
## - `Adult Mortality` 1 4.0 4182.2 2608.8
## - `under-five deaths` 1 6.9 4185.2 2610.0
## - `Hepatitis B` 1 6.9 4185.2 2610.0
## - `Income composition of resources` 1 7.7 4186.0 2610.3
## - Alcohol 1 16.2 4194.5 2613.7
## <none> 4178.3 2614.7
## - `thinness 5-9 years` 1 19.8 4198.1 2615.1
## - Schooling 1 38.3 4216.5 2622.3
## - Year 1 456.7 4635.0 2778.3
## - `HIV/AIDS` 1 1057.9 5236.1 2979.4
## - Country 132 18018.1 22196.4 4390.7
##
## Step: AIC=2607.59
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `Hepatitis B` + Measles + `under-five deaths` + `Total expenditure` +
## `HIV/AIDS` + Population + `thinness 5-9 years` + `Income composition of resources`
## +
## Schooling
##
## Df Sum of Sq RSS AIC
## - Population 1 1.0 4180.0 2600.6
## - Measles 1 1.5 4180.6 2600.8
## - `Total expenditure` 1 1.9 4181.0 2600.9
## - `Adult Mortality` 1 3.9 4183.0 2601.7
## - `Hepatitis B` 1 6.8 4185.9 2602.9
## - `under-five deaths` 1 6.8 4185.9 2602.9
## - `Income composition of resources` 1 7.5 4186.6 2603.1
## - Alcohol 1 16.0 4195.1 2606.5
## <none> 4179.1 2607.6
## - `thinness 5-9 years` 1 19.8 4198.9 2608.0
## - Schooling 1 37.8 4216.8 2615.0
## - Year 1 479.7 4658.7 2779.4
## - `HIV/AIDS` 1 1057.2 5236.3 2972.1
## - Country 132 18877.3 23056.3 4446.0
##
## Step: AIC=2600.56
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `Hepatitis B` + Measles + `under-five deaths` + `Total expenditure` +
## `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - Measles 1 1.3 4181.3 2593.7
## - `Total expenditure` 1 1.9 4181.9 2593.9
## - `Adult Mortality` 1 3.8 4183.9 2594.7
## - `under-five deaths` 1 5.9 4185.9 2595.5
## - `Hepatitis B` 1 6.9 4187.0 2595.9
## - `Income composition of resources` 1 7.5 4187.5 2596.1
## - Alcohol 1 16.0 4196.0 2599.4
## <none> 4180.0 2600.6

```

```

## - `thinness 5-9 years`      1      19.4  4199.4 2600.8
## - Schooling                 1      38.2  4218.3 2608.2
## - Year                      1     481.2  4661.3 2772.8
## - `HIV/AIDS`               1    1057.0  5237.0 2964.9
## - Country                   132   18943.2 23123.2 4443.4
##
## Step:  AIC=2593.67
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `Hepatitis B` + `under-five deaths` + `Total expenditure` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##                                Df Sum of Sq    RSS    AIC
## - `Total expenditure`      1         1.8  4183.2 2587.0
## - `Adult Mortality`        1         3.8  4185.1 2587.8
## - `under-five deaths`      1         6.9  4188.3 2589.0
## - `Hepatitis B`           1         7.0  4188.3 2589.0
## - `Income composition of resources` 1         7.4  4188.8 2589.2
## - Alcohol                  1        16.0  4197.3 2592.5
## <none>                     4181.3 2593.7
## - `thinness 5-9 years`     1        19.8  4201.2 2594.1
## - Schooling                 1        39.0  4220.3 2601.6
## - Year                      1       482.0  4663.3 2766.2
## - `HIV/AIDS`               1    1056.0  5237.3 2957.6
## - Country                   132   18949.3 23130.6 4436.5
##
## Step:  AIC=2586.97
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `Hepatitis B` + `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##                                Df Sum of Sq    RSS    AIC
## - `Adult Mortality`      1         3.8  4187.0 2581.1
## - `Hepatitis B`          1         6.7  4189.9 2582.2
## - `under-five deaths`    1         6.9  4190.1 2582.3
## - `Income composition of resources` 1         7.5  4190.7 2582.5
## - Alcohol                 1        15.8  4199.0 2585.8
## <none>                     4183.2 2587.0
## - `thinness 5-9 years`     1        19.7  4202.9 2587.3
## - Schooling                 1        39.2  4222.3 2594.9
## - Year                      1       480.2  4663.3 2758.8
## - `HIV/AIDS`               1    1054.2  5237.3 2950.2
## - Country                   132   19069.7 23252.8 4437.8
##
## Step:  AIC=2581.07
## `Life expectancy` ~ Country + Year + Alcohol + `Hepatitis B` +
##   `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##                                Df Sum of Sq    RSS    AIC
## - `Hepatitis B`          1         6.5  4193.5 2576.2
## - `under-five deaths`    1         6.6  4193.6 2576.3

```

```
## - `Income composition of resources` 1 7.7 4194.7 2576.7
## - Alcohol 1 15.9 4202.9 2579.9
## <none> 4187.0 2581.1
## - `thinness 5-9 years` 1 19.8 4206.8 2581.5
## - Schooling 1 39.5 4226.5 2589.2
## - Year 1 486.6 4673.5 2754.9
## - `HIV/AIDS` 1 1104.8 5291.8 2959.8
## - Country 132 24235.1 28422.1 4761.4
##
## Step: AIC=2576.23
## `Life expectancy` ~ Country + Year + Alcohol + `under-five deaths` +
## `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - `Income composition of resources` 1 7.9 4201.4 2571.9
## - `under-five deaths` 1 8.3 4201.7 2572.1
## - Alcohol 1 15.7 4209.2 2575.0
## <none> 4193.5 2576.2
## - `thinness 5-9 years` 1 20.7 4214.2 2576.9
## - Schooling 1 39.6 4233.1 2584.3
## - Year 1 512.2 4705.7 2758.9
## - `HIV/AIDS` 1 1109.8 5303.3 2956.0
## - Country 132 24271.8 28465.2 4756.5
##
## Step: AIC=2571.94
## `Life expectancy` ~ Country + Year + Alcohol + `under-five deaths` +
## `HIV/AIDS` + `thinness 5-9 years` + Schooling
##
## Df Sum of Sq RSS AIC
## - `under-five deaths` 1 8.0 4209 2567.7
## - Alcohol 1 15.0 4216 2570.4
## <none> 4201 2571.9
## - `thinness 5-9 years` 1 20.9 4222 2572.7
## - Schooling 1 39.4 4241 2579.9
## - Year 1 643.2 4845 2799.4
## - `HIV/AIDS` 1 1103.8 5305 2949.2
## - Country 132 28764.7 32966 4991.1
##
## Step: AIC=2567.66
## `Life expectancy` ~ Country + Year + Alcohol + `HIV/AIDS` + `thinness 5-9 years` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - Alcohol 1 13.6 4223 2565.6
## <none> 4209 2567.7
## - `thinness 5-9 years` 1 20.9 4230 2568.4
## - Schooling 1 44.2 4254 2577.5
## - Year 1 658.7 4868 2800.0
## - `HIV/AIDS` 1 1103.4 5313 2944.1
## - Country 132 28758.4 32968 4983.8
##
```

```
## Step: AIC=2565.59
## `Life expectancy` ~ Country + Year + `HIV/AIDS` + `thinness 5-9 years` +
##   Schooling
##
##           Df Sum of Sq  RSS   AIC
## <none>                4223 2565.6
## - `thinness 5-9 years`    1    20.9  4244 2566.3
## - Schooling              1    42.1  4265 2574.6
## - Year                   1   699.4  4922 2810.9
## - `HIV/AIDS`             1  1139.0  5362 2952.0
## - Country               132 28811.4 33034 4979.7
```

```
corr_mod_2_back_bic = step(corr_removed_model_2, direction = "backward", k = log(n))
```

```
## Start: AIC=2648.28
## `Life expectancy` ~ Country + Year + Status + `Adult Mortality` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `Income composition of resources` + Schooling
##
##
## Step: AIC=2648.28
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `percentage expenditure` + `Hepatitis B` + Measles + BMI +
##   `under-five deaths` + Polio + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `Income composition of resources` + Schooling
##
##
```

	Df	Sum of Sq	RSS	AIC
## - Polio	1	0.4	4188.7	2641.0
## - Population	1	0.5	4188.8	2641.1
## - BMI	1	0.6	4189.0	2641.1
## - `percentage expenditure`	1	0.7	4189.1	2641.2
## - Diphtheria	1	0.7	4189.1	2641.2
## - GDP	1	1.2	4189.5	2641.3
## - Measles	1	1.8	4190.2	2641.6
## - `Total expenditure`	1	1.9	4190.3	2641.6
## - `Adult Mortality`	1	3.9	4192.3	2642.4
## - `Hepatitis B`	1	4.5	4192.8	2642.6
## - `under-five deaths`	1	6.6	4194.9	2643.4
## - `Income composition of resources`	1	7.7	4196.0	2643.9
## - `thinness 1-19 years`	1	7.7	4196.0	2643.9
## - Alcohol	1	17.0	4205.4	2647.6
## <none>			4188.3	2648.3
## - Schooling	1	38.2	4226.5	2655.8
## - Year	1	448.0	4636.3	2808.4
## - `HIV/AIDS`	1	1036.4	5224.8	3005.5
## - Country	132	17376.8	21565.1	4372.8

```
##
## Step: AIC=2641.03
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `percentage expenditure` + `Hepatitis B` + Measles + BMI +
##   `under-five deaths` + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `Income composition of resources` + Schooling
##
##
```

	Df	Sum of Sq	RSS	AIC
## - Diphtheria	1	0.5	4189.2	2633.8
## - Population	1	0.5	4189.3	2633.8
## - BMI	1	0.6	4189.4	2633.9
## - `percentage expenditure`	1	0.7	4189.5	2633.9
## - GDP	1	1.2	4189.9	2634.1
## - Measles	1	1.8	4190.6	2634.4
## - `Total expenditure`	1	2.0	4190.7	2634.4
## - `Adult Mortality`	1	3.9	4192.7	2635.2


```

## - `Hepatitis B` 1 4.2 4193.0 2635.3
## - `under-five deaths` 1 6.5 4195.3 2636.2
## - `thinness 1-19 years` 1 7.4 4196.2 2636.6
## - `Income composition of resources` 1 7.7 4196.4 2636.6
## - Alcohol 1 17.0 4205.7 2640.3
## <none> 4188.7 2641.0
## - Schooling 1 38.1 4226.8 2648.5
## - Year 1 448.0 4636.8 2801.2
## - `HIV/AIDS` 1 1036.2 5225.0 2998.1
## - Country 132 17404.2 21593.0 4367.5
##
## Step: AIC=2633.82
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `percentage expenditure` + `Hepatitis B` + Measles + BMI +
## `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + Population + `thinness 1-19 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - Population 1 0.5 4189.8 2626.6
## - BMI 1 0.6 4189.9 2626.7
## - `percentage expenditure` 1 0.7 4189.9 2626.7
## - GDP 1 1.2 4190.4 2626.9
## - Measles 1 1.8 4191.1 2627.1
## - `Total expenditure` 1 1.9 4191.2 2627.2
## - `Adult Mortality` 1 3.9 4193.1 2627.9
## - `under-five deaths` 1 6.6 4195.8 2629.0
## - `Hepatitis B` 1 7.3 4196.6 2629.3
## - `thinness 1-19 years` 1 7.4 4196.6 2629.3
## - `Income composition of resources` 1 8.1 4197.3 2629.6
## - Alcohol 1 17.0 4206.2 2633.1
## <none> 4189.2 2633.8
## - Schooling 1 38.4 4227.6 2641.4
## - Year 1 447.7 4636.9 2793.8
## - `HIV/AIDS` 1 1041.7 5230.9 2992.6
## - Country 132 17615.7 21804.9 4376.2
##
## Step: AIC=2626.62
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
## `percentage expenditure` + `Hepatitis B` + Measles + BMI +
## `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + `thinness 1-19 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - BMI 1 0.7 4190.4 2619.5
## - `percentage expenditure` 1 0.7 4190.5 2619.5
## - GDP 1 1.1 4190.9 2619.7
## - Measles 1 1.6 4191.4 2619.9
## - `Total expenditure` 1 2.0 4191.7 2620.0
## - `Adult Mortality` 1 3.8 4193.6 2620.7
## - `under-five deaths` 1 6.0 4195.8 2621.6

```

```

## - `thinness 1-19 years`      1      7.3  4197.1 2622.1
## - `Hepatitis B`              1      7.4  4197.2 2622.1
## - `Income composition of resources` 1      8.1  4197.8 2622.4
## - Alcohol                    1     17.0  4206.8 2625.9
## <none>                       4189.8 2626.6
## - Schooling                  1     38.7  4228.5 2634.4
## - Year                       1    449.1  4638.9 2787.1
## - `HIV/AIDS`                 1   1041.8  5231.6 2985.4
## - Country                    132  17666.8 21856.6 4372.7
##
## Step: AIC=2619.47
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `percentage expenditure` + `Hepatitis B` + Measles + `under-five deaths` +
##   `Total expenditure` + `HIV/AIDS` + GDP + `thinness 1-19 years` +
##   `Income composition of resources` + Schooling
##
##                                     Df Sum of Sq      RSS      AIC
## - `percentage expenditure`      1      0.8  4191.2 2612.4
## - GDP                           1      1.3  4191.7 2612.6
## - Measles                       1      1.7  4192.1 2612.7
## - `Total expenditure`           1      1.8  4192.3 2612.8
## - `Adult Mortality`             1      3.8  4194.2 2613.6
## - `under-five deaths`           1      6.0  4196.5 2614.4
## - `Hepatitis B`                 1      7.2  4197.7 2614.9
## - `thinness 1-19 years`         1      7.4  4197.8 2615.0
## - `Income composition of resources` 1      7.8  4198.2 2615.1
## - Alcohol                       1     17.0  4207.4 2618.7
## <none>                           4190.4 2619.5
## - Schooling                     1     38.8  4229.2 2627.2
## - Year                           1    449.2  4639.6 2780.0
## - `HIV/AIDS`                     1   1046.6  5237.0 2979.7
## - Country                       132  18049.9 22240.3 4394.0
##
## Step: AIC=2612.37
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `Hepatitis B` + Measles + `under-five deaths` + `Total expenditure` +
##   `HIV/AIDS` + GDP + `thinness 1-19 years` + `Income composition of resources` +
##   Schooling
##
##                                     Df Sum of Sq      RSS      AIC
## - GDP                           1      0.8  4192.0 2605.3
## - Measles                       1      1.7  4192.9 2605.6
## - `Total expenditure`           1      1.9  4193.1 2605.7
## - `Adult Mortality`             1      3.8  4195.0 2606.5
## - `under-five deaths`           1      6.1  4197.3 2607.4
## - `Hepatitis B`                 1      7.3  4198.5 2607.8
## - `thinness 1-19 years`         1      7.4  4198.6 2607.9
## - `Income composition of resources` 1      7.8  4199.0 2608.0
## - Alcohol                       1     16.7  4207.9 2611.5
## <none>                           4191.2 2612.4
## - Schooling                     1     39.3  4230.5 2620.4
## - Year                           1    452.0  4643.2 2773.8

```

```

## - `HIV/AIDS`          1      1045.8  5237.0 2972.3
## - Country              132     18083.2 22274.4 4389.1
##
## Step: AIC=2605.28
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `Hepatitis B` + Measles + `under-five deaths` + `Total expenditure` +
##   `HIV/AIDS` + `thinness 1-19 years` + `Income composition of resources` +
##   Schooling
##
##                                Df Sum of Sq      RSS      AIC
## - Measles                     1         1.7  4193.7 2598.5
## - `Total expenditure`         1         1.8  4193.8 2598.6
## - `Adult Mortality`          1         3.8  4195.8 2599.3
## - `under-five deaths`        1         6.1  4198.1 2600.2
## - `Hepatitis B`              1         7.2  4199.2 2600.7
## - `thinness 1-19 years`      1         7.4  4199.4 2600.8
## - `Income composition of resources` 1         7.6  4199.6 2600.9
## - Alcohol                     1        16.5  4208.5 2604.3
## <none>                        4192.0 2605.3
## - Schooling                   1        38.8  4230.8 2613.1
## - Year                        1       474.9  4666.9 2774.8
## - `HIV/AIDS`                 1      1045.2  5237.2 2964.9
## - Country                     132     18953.6 23145.6 4445.0
##
## Step: AIC=2598.53
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `Hepatitis B` + `under-five deaths` + `Total expenditure` +
##   `HIV/AIDS` + `thinness 1-19 years` + `Income composition of resources` +
##   Schooling
##
##                                Df Sum of Sq      RSS      AIC
## - `Total expenditure`         1         1.7  4195.4 2591.8
## - `Adult Mortality`          1         3.7  4197.4 2592.6
## - `under-five deaths`        1         7.2  4200.9 2594.0
## - `Hepatitis B`              1         7.3  4201.0 2594.0
## - `thinness 1-19 years`      1         7.5  4201.2 2594.1
## - `Income composition of resources` 1         7.6  4201.3 2594.1
## - Alcohol                     1        16.4  4210.1 2597.6
## <none>                        4193.7 2598.5
## - Schooling                   1        39.7  4233.4 2606.6
## - Year                        1       475.5  4669.2 2768.2
## - `HIV/AIDS`                 1     1043.8  5237.5 2957.6
## - Country                     132     18960.2 23153.9 4438.1
##
## Step: AIC=2591.8
## `Life expectancy` ~ Country + Year + `Adult Mortality` + Alcohol +
##   `Hepatitis B` + `under-five deaths` + `HIV/AIDS` + `thinness 1-19 years` +
##   `Income composition of resources` + Schooling
##
##                                Df Sum of Sq      RSS      AIC
## - `Adult Mortality`          1         3.7  4199.2 2585.9
## - `Hepatitis B`              1         7.1  4202.5 2587.2

```

```

## - `under-five deaths` 1 7.2 4202.6 2587.2
## - `thinness 1-19 years` 1 7.4 4202.9 2587.3
## - `Income composition of resources` 1 7.7 4203.1 2587.4
## - Alcohol 1 16.3 4211.7 2590.8
## <none> 4195.4 2591.8
## - Schooling 1 39.8 4235.3 2600.0
## - Year 1 473.8 4669.2 2760.8
## - `HIV/AIDS` 1 1042.1 5237.5 2950.2
## - Country 132 19087.0 23282.4 4439.9
##
## Step: AIC=2585.86
## `Life expectancy` ~ Country + Year + Alcohol + `Hepatitis B` +
## `under-five deaths` + `HIV/AIDS` + `thinness 1-19 years` +
## `Income composition of resources` + Schooling
##
## Df Sum of Sq RSS AIC
## - `Hepatitis B` 1 6.8 4206.0 2581.1
## - `under-five deaths` 1 6.9 4206.0 2581.2
## - `thinness 1-19 years` 1 7.7 4206.8 2581.5
## - `Income composition of resources` 1 7.9 4207.0 2581.5
## - Alcohol 1 16.4 4215.5 2584.9
## <none> 4199.2 2585.9
## - Schooling 1 40.2 4239.4 2594.2
## - Year 1 480.2 4679.3 2757.0
## - `HIV/AIDS` 1 1092.7 5291.9 2959.8
## - Country 132 24329.7 28528.8 4767.6
##
## Step: AIC=2581.13
## `Life expectancy` ~ Country + Year + Alcohol + `under-five deaths` +
## `HIV/AIDS` + `thinness 1-19 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - `Income composition of resources` 1 8.1 4214.1 2576.9
## - `thinness 1-19 years` 1 8.2 4214.2 2576.9
## - `under-five deaths` 1 8.6 4214.6 2577.1
## - Alcohol 1 16.2 4222.1 2580.0
## <none> 4206.0 2581.1
## - Schooling 1 40.3 4246.2 2589.4
## - Year 1 506.0 4711.9 2761.0
## - `HIV/AIDS` 1 1097.7 5303.6 2956.1
## - Country 132 24365.5 28571.4 4762.6
##
## Step: AIC=2576.9
## `Life expectancy` ~ Country + Year + Alcohol + `under-five deaths` +
## `HIV/AIDS` + `thinness 1-19 years` + Schooling
##
## Df Sum of Sq RSS AIC
## - `thinness 1-19 years` 1 8.3 4222 2572.7
## - `under-five deaths` 1 8.3 4222 2572.8
## - Alcohol 1 15.5 4230 2575.5
## <none> 4214 2576.9

```

```
## - Schooling          1      40.1  4254 2585.1
## - Year               1      636.1  4850 2801.3
## - `HIV/AIDS`        1     1091.5  5306 2949.3
## - Country           132    28893.8 33108 4998.2
##
## Step:  AIC=2572.72
## `Life expectancy` ~ Country + Year + Alcohol + `under-five deaths` +
##   `HIV/AIDS` + Schooling
##
##              Df Sum of Sq  RSS    AIC
## - `under-five deaths`  1        7.9  4230 2568.4
## - Alcohol              1       15.0  4237 2571.2
## <none>                  4222 2572.7
## - Schooling            1       39.7  4262 2580.8
## - Year                 1      628.8  4851 2794.2
## - `HIV/AIDS`          1     1083.2  5306 2941.9
## - Country              132    29448.8 33671 5018.6
##
## Step:  AIC=2568.41
## `Life expectancy` ~ Country + Year + Alcohol + `HIV/AIDS` + Schooling
##
##              Df Sum of Sq  RSS    AIC
## - Alcohol          1       13.7  4244 2566.3
## <none>              4230 2568.4
## - Schooling        1       44.5  4275 2578.3
## - Year              1      644.1  4874 2794.7
## - `HIV/AIDS`       1     1082.9  5313 2936.9
## - Country           132    29640.5 33871 5021.0
##
## Step:  AIC=2566.31
## `Life expectancy` ~ Country + Year + `HIV/AIDS` + Schooling
##
##              Df Sum of Sq  RSS    AIC
## <none>          4244 2566.3
## - Schooling    1       42.4  4286 2575.3
## - Year          1      684.3  4928 2805.4
## - `HIV/AIDS`   1     1118.5  5362 2944.6
## - Country      132    29642.9 33887 5014.3
```

```
corr_mod_3_back_bic = step(corr_removed_model_3, direction = "backward", k = log(n))
```

```
## Start: AIC=2646.98
## `Life expectancy` ~ Country + Year + Status + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
## Step: AIC=2646.98
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
```

	Df	Sum of Sq	RSS	AIC
## - Polio	1	0.1	4147.8	2639.6
## - Diphtheria	1	0.2	4147.9	2639.7
## - Population	1	0.3	4147.9	2639.7
## - `thinness 1-19 years`	1	0.3	4148.0	2639.7
## - BMI	1	0.5	4148.1	2639.8
## - `percentage expenditure`	1	1.1	4148.7	2640.0
## - GDP	1	1.6	4149.3	2640.2
## - `Total expenditure`	1	1.9	4149.6	2640.3
## - Measles	1	2.8	4150.5	2640.7
## - `Adult Mortality`	1	3.9	4151.6	2641.1
## - `Hepatitis B`	1	4.8	4152.4	2641.5
## - `Income composition of resources`	1	7.6	4155.2	2642.6
## - `thinness 5-9 years`	1	12.5	4160.1	2644.5
## - Alcohol	1	12.8	4160.4	2644.7
## <none>			4147.6	2647.0
## - `infant deaths`	1	28.4	4176.1	2650.8
## - `under-five deaths`	1	32.1	4179.7	2652.3
## - Schooling	1	37.0	4184.6	2654.2
## - Year	1	456.5	4604.1	2811.8
## - `HIV/AIDS`	1	1016.8	5164.4	3001.1
## - Country	132	16527.0	20674.7	4318.0

```
##
## Step: AIC=2639.63
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
```

	Df	Sum of Sq	RSS	AIC
## - Diphtheria	1	0.2	4147.9	2632.3
## - Population	1	0.3	4148.0	2632.3
## - `thinness 1-19 years`	1	0.3	4148.1	2632.3

```

## - BMI 1 0.5 4148.3 2632.4
## - `percentage expenditure` 1 1.1 4148.8 2632.6
## - GDP 1 1.6 4149.4 2632.9
## - `Total expenditure` 1 2.0 4149.7 2633.0
## - Measles 1 2.9 4150.6 2633.4
## - `Adult Mortality` 1 3.9 4151.7 2633.8
## - `Hepatitis B` 1 4.7 4152.4 2634.1
## - `Income composition of resources` 1 7.6 4155.4 2635.2
## - `thinness 5-9 years` 1 12.6 4160.3 2637.2
## - Alcohol 1 12.8 4160.5 2637.3
## <none> 4147.8 2639.6
## - `infant deaths` 1 28.6 4176.4 2643.6
## - `under-five deaths` 1 32.2 4180.0 2645.0
## - Schooling 1 36.9 4184.7 2646.8
## - Year 1 456.6 4604.4 2804.4
## - `HIV/AIDS` 1 1016.7 5164.4 2993.7
## - Country 132 16542.4 20690.1 4311.9
##
## Step: AIC=2632.29
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
## BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + Population + `thinness 1-19 years` + `thinness 5-9 years` +
## `Income composition of resources` + Schooling
##
## Df Sum of Sq RSS AIC
## - Population 1 0.3 4148.2 2625.0
## - `thinness 1-19 years` 1 0.3 4148.2 2625.0
## - BMI 1 0.5 4148.4 2625.1
## - `percentage expenditure` 1 1.1 4149.0 2625.3
## - GDP 1 1.6 4149.5 2625.5
## - `Total expenditure` 1 2.0 4149.9 2625.7
## - Measles 1 2.8 4150.8 2626.0
## - `Adult Mortality` 1 3.9 4151.8 2626.4
## - `Hepatitis B` 1 7.1 4155.0 2627.7
## - `Income composition of resources` 1 7.9 4155.8 2628.0
## - `thinness 5-9 years` 1 12.6 4160.5 2629.9
## - Alcohol 1 12.8 4160.7 2629.9
## <none> 4147.9 2632.3
## - `infant deaths` 1 28.9 4176.9 2636.3
## - `under-five deaths` 1 32.6 4180.5 2637.8
## - Schooling 1 37.1 4185.0 2639.6
## - Year 1 456.9 4604.9 2797.2
## - `HIV/AIDS` 1 1020.4 5168.3 2987.6
## - Country 132 16656.3 20804.2 4313.5
##
## Step: AIC=2624.99
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
## BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + `thinness 1-19 years` + `thinness 5-9 years` + `Income composition of resources` +

```

```

##      Schooling
##
##              Df Sum of Sq      RSS      AIC
## - `thinness 1-19 years`      1      0.3  4148.5  2617.7
## - BMI                        1      0.5  4148.7  2617.8
## - `percentage expenditure`    1      1.1  4149.3  2618.0
## - GDP                        1      1.6  4149.8  2618.2
## - `Total expenditure`        1      1.9  4150.1  2618.4
## - Measles                    1      3.0  4151.2  2618.8
## - `Adult Mortality`          1      4.0  4152.2  2619.2
## - `Hepatitis B`              1      7.0  4155.2  2620.4
## - `Income composition of resources` 1      7.9  4156.1  2620.7
## - Alcohol                    1     12.9  4161.1  2622.7
## - `thinness 5-9 years`       1     12.9  4161.1  2622.7
## <none>                      4148.2  2625.0
## - `infant deaths`           1     29.6  4177.8  2629.3
## - `under-five deaths`       1     32.9  4181.1  2630.6
## - Schooling                  1     36.9  4185.1  2632.2
## - Year                       1    456.7  4604.9  2789.8
## - `HIV/AIDS`                 1   1021.7  5169.9  2980.7
## - Country                    132  16656.9 20805.1  4306.2
##
## Step:  AIC=2617.69
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##              Df Sum of Sq      RSS      AIC
## - BMI                        1      0.5  4149.0  2610.5
## - `percentage expenditure`    1      1.1  4149.5  2610.7
## - GDP                        1      1.6  4150.1  2610.9
## - `Total expenditure`        1      1.9  4150.4  2611.1
## - Measles                    1      2.9  4151.4  2611.5
## - `Adult Mortality`          1      4.0  4152.5  2611.9
## - `Hepatitis B`              1      7.1  4155.6  2613.1
## - `Income composition of resources` 1      7.9  4156.4  2613.4
## - Alcohol                    1     12.8  4161.3  2615.4
## <none>                      4148.5  2617.7
## - `thinness 5-9 years`       1     22.2  4170.7  2619.1
## - `infant deaths`           1     29.4  4177.9  2621.9
## - `under-five deaths`       1     32.7  4181.2  2623.2
## - Schooling                  1     36.8  4185.3  2624.9
## - Year                       1    456.5  4605.0  2782.4
## - `HIV/AIDS`                 1   1021.7  5170.1  2973.3
## - Country                    132  16656.6 20805.1  4298.8
##
## Step:  AIC=2610.49
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   `under-five deaths` + `Total expenditure` + `HIV/AIDS` +

```



```

##      GDP + `thinness 5-9 years` + `Income composition of resources` +
##      Schooling
##
##              Df Sum of Sq      RSS      AIC
## - `percentage expenditure`      1      1.2  4150.2  2603.5
## - GDP                          1      1.7  4150.7  2603.8
## - `Total expenditure`          1      1.8  4150.8  2603.8
## - Measles                      1      3.0  4152.0  2604.3
## - `Adult Mortality`           1      4.0  4153.0  2604.7
## - `Hepatitis B`               1      6.9  4155.9  2605.8
## - `Income composition of resources` 1      7.7  4156.6  2606.1
## - Alcohol                     1     12.8  4161.8  2608.2
## <none>                        4149.0  2610.5
## - `thinness 5-9 years`        1     22.4  4171.4  2611.9
## - `infant deaths`             1     29.4  4178.4  2614.7
## - `under-five deaths`         1     32.7  4181.7  2616.0
## - Schooling                   1     36.8  4185.8  2617.7
## - Year                       1    456.8  4605.8  2775.3
## - `HIV/AIDS`                 1   1026.4  5175.4  2967.6
## - Country                     132  16982.3 21131.3  4317.0
##
## Step:  AIC=2603.55
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##      Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##      `Total expenditure` + `HIV/AIDS` + GDP + `thinness 5-9 years` +
##      `Income composition of resources` + Schooling
##
##              Df Sum of Sq      RSS      AIC
## - GDP                          1      0.9  4151.0  2596.5
## - `Total expenditure`          1      1.9  4152.1  2596.9
## - Measles                      1      3.0  4153.2  2597.3
## - `Adult Mortality`           1      4.0  4154.1  2597.7
## - `Hepatitis B`               1      7.0  4157.2  2598.9
## - `Income composition of resources` 1      7.7  4157.8  2599.2
## - Alcohol                     1     12.5  4162.7  2601.1
## <none>                        4150.2  2603.5
## - `thinness 5-9 years`        1     22.3  4172.5  2605.0
## - `infant deaths`             1     29.1  4179.2  2607.7
## - `under-five deaths`         1     32.4  4182.5  2609.0
## - Schooling                   1     37.5  4187.6  2611.0
## - Year                       1    459.9  4610.1  2769.5
## - `HIV/AIDS`                 1   1025.3  5175.4  2960.2
## - Country                     132  17019.7 21169.8  4312.6
##
## Step:  AIC=2596.49
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##      Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##      `Total expenditure` + `HIV/AIDS` + `thinness 5-9 years` +
##      `Income composition of resources` + Schooling
##
##              Df Sum of Sq      RSS      AIC
## - `Total expenditure`          1      1.8  4152.9  2589.8

```

```

## - Measles 1 3.0 4154.0 2590.3
## - `Adult Mortality` 1 3.9 4155.0 2590.6
## - `Hepatitis B` 1 6.9 4158.0 2591.8
## - `Income composition of resources` 1 7.5 4158.5 2592.0
## - Alcohol 1 12.3 4163.3 2594.0
## <none> 4151.0 2596.5
## - `thinness 5-9 years` 1 22.3 4173.4 2597.9
## - `infant deaths` 1 29.0 4180.0 2600.6
## - `under-five deaths` 1 32.3 4183.3 2601.9
## - Schooling 1 37.0 4188.0 2603.7
## - Year 1 483.5 4634.5 2770.8
## - `HIV/AIDS` 1 1024.5 5175.5 2952.8
## - Country 132 17885.0 22036.0 4371.4
##
## Step: AIC=2589.8
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
## `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - Measles 1 2.9 4155.7 2583.5
## - `Adult Mortality` 1 3.9 4156.8 2584.0
## - `Hepatitis B` 1 6.7 4159.6 2585.1
## - `Income composition of resources` 1 7.6 4160.4 2585.4
## - Alcohol 1 12.2 4165.0 2587.2
## <none> 4152.9 2589.8
## - `thinness 5-9 years` 1 22.2 4175.1 2591.2
## - `infant deaths` 1 29.1 4181.9 2593.9
## - `under-five deaths` 1 32.4 4185.2 2595.2
## - Schooling 1 37.2 4190.0 2597.1
## - Year 1 481.7 4634.5 2763.3
## - `HIV/AIDS` 1 1022.7 5175.5 2945.4
## - Country 132 18014.7 22167.6 4373.8
##
## Step: AIC=2583.53
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `Hepatitis B` + `under-five deaths` + `HIV/AIDS` +
## `thinness 5-9 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - `Adult Mortality` 1 3.9 4159.6 2577.7
## - `Hepatitis B` 1 6.8 4162.5 2578.8
## - `Income composition of resources` 1 7.5 4163.2 2579.1
## - Alcohol 1 12.2 4167.9 2581.0
## <none> 4155.7 2583.5
## - `thinness 5-9 years` 1 22.8 4178.5 2585.1
## - `infant deaths` 1 27.4 4183.2 2587.0
## - `under-five deaths` 1 31.0 4186.7 2588.4
## - Schooling 1 38.3 4194.0 2591.2
## - Year 1 482.8 4638.5 2757.4

```

```

## - `HIV/AIDS`      1      1021.8  5177.5 2938.6
## - Country          132     18052.6 22208.3 4369.4
##
## Step:  AIC=2577.67
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `Hepatitis B` + `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##              Df Sum of Sq      RSS      AIC
## - `Hepatitis B`      1         6.6  4166.2 2572.9
## - `Income composition of resources`  1         7.7  4167.3 2573.3
## - Alcohol            1        12.3  4171.9 2575.1
## <none>                                4159.6 2577.7
## - `thinness 5-9 years`      1        22.9  4182.5 2579.3
## - `infant deaths`          1        27.4  4187.0 2581.1
## - `under-five deaths`      1        30.8  4190.4 2582.4
## - Schooling              1        38.6  4198.2 2585.5
## - Year                  1       489.2  4648.8 2753.6
## - `HIV/AIDS`            1       1071.3  5230.9 2948.2
## - Country              132     22622.6 26782.2 4670.8
##
## Step:  AIC=2572.86
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##              Df Sum of Sq      RSS      AIC
## - `Income composition of resources`  1         7.9  4174.1 2568.6
## - Alcohol            1        12.1  4178.3 2570.2
## <none>                                4166.2 2572.9
## - `thinness 5-9 years`      1        23.8  4190.0 2574.9
## - `infant deaths`          1        27.3  4193.5 2576.2
## - `under-five deaths`      1        31.2  4197.4 2577.8
## - Schooling              1        38.7  4204.8 2580.7
## - Year                  1       515.0  4681.2 2757.7
## - `HIV/AIDS`            1      1076.3  5242.5 2944.4
## - Country              132     22626.1 26792.3 4664.0
##
## Step:  AIC=2568.59
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   Schooling
##
##              Df Sum of Sq      RSS      AIC
## - Alcohol            1        11.5  4185.6 2565.7
## <none>                                4174.1 2568.6
## - `thinness 5-9 years`      1        24.1  4198.2 2570.7
## - `infant deaths`          1        27.3  4201.4 2571.9
## - `under-five deaths`      1        31.1  4205.2 2573.4
## - Schooling              1        38.5  4212.6 2576.3
## - Year                  1       646.6  4820.7 2798.7
## - `HIV/AIDS`            1      1070.3  5244.4 2937.6

```

```
## - Country          132    26354.1 30528.2 4871.8
##
## Step:  AIC=2565.72
## `Life expectancy` ~ Country + Year + `infant deaths` + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + Schooling
##
##              Df Sum of Sq    RSS    AIC
## <none>                4185.6 2565.7
## - `thinness 5-9 years`  1      24.3  4209.9 2567.9
## - `infant deaths`      1      30.8  4216.4 2570.4
## - `under-five deaths`  1      34.4  4220.0 2571.8
## - Schooling            1      37.0  4222.6 2572.8
## - Year                 1     686.5  4872.1 2808.7
## - `HIV/AIDS`          1    1099.8  5285.4 2943.0
## - Country             132    26345.0 30530.7 4864.6
```

```
metrics_corr_mod_1_back_aic = calc_model_metrics(corr_mod_1_back_aic)
metrics_corr_mod_2_back_aic = calc_model_metrics(corr_mod_2_back_aic)
metrics_corr_mod_3_back_aic = calc_model_metrics(corr_mod_3_back_aic)

metrics_corr_mod_1_back_bic = calc_model_metrics(corr_mod_1_back_bic)
metrics_corr_mod_2_back_bic = calc_model_metrics(corr_mod_2_back_bic)
metrics_corr_mod_3_back_bic = calc_model_metrics(corr_mod_3_back_bic)
```

```
# AIC and BIC for models with log transformations
tranform_mod_1_back_aic = step(log_transform_1, direction = "backward")
```

```
## Start: AIC=1827.61
## `Life expectancy` ~ Country + Year + Status + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(Population) + log(GDP)
##
##
## Step: AIC=1827.61
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(Population) + log(GDP)
##
##
##           Df Sum of Sq    RSS    AIC
## - log(Population)      1      0.0 4144.2 1825.6
## - Polio                 1      0.2 4144.4 1825.7
## - Diphtheria            1      0.2 4144.4 1825.7
## - Population            1      0.2 4144.4 1825.7
## - BMI                   1      0.5 4144.7 1825.8
## - `thinness 1-19 years` 1      0.5 4144.7 1825.8
## - `Total expenditure`  1      1.7 4145.9 1826.3
## - `percentage expenditure` 1      2.0 4146.2 1826.4
## - Measles               1      2.8 4147.0 1826.7
## - log(GDP)              1      3.4 4147.6 1827.0
## - GDP                   1      3.5 4147.7 1827.0
## - `Adult Mortality`     1      3.6 4147.8 1827.0
## - `Hepatitis B`         1      4.8 4148.9 1827.5
## <none>                  4144.2 1827.6
## - `Income composition of resources` 1      7.8 4151.9 1828.7
## - `thinness 5-9 years`  1     12.3 4156.5 1830.5
## - Alcohol               1     12.5 4156.6 1830.6
## - `infant deaths`       1     28.3 4172.4 1836.8
## - `under-five deaths`   1     32.1 4176.3 1838.3
## - Schooling              1     37.7 4181.8 1840.5
## - Year                   1    458.5 4602.6 1998.6
## - `HIV/AIDS`            1   1018.6 5162.8 2188.0
## - Country               132  16162.9 20307.1 4184.3
##
##
## Step: AIC=1825.61
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
##           Df Sum of Sq    RSS    AIC
## - Polio                 1      0.2 4144.4 1823.7
```

```

## - Diphtheria          1      0.2  4144.4 1823.7
## - Population          1      0.2  4144.4 1823.7
## - BMI                 1      0.5  4144.7 1823.8
## - `thinness 1-19 years` 1      0.5  4144.7 1823.8
## - `Total expenditure`  1      1.8  4145.9 1824.3
## - `percentage expenditure` 1     2.0  4146.2 1824.4
## - Measles             1      2.8  4147.0 1824.7
## - log(GDP)            1      3.4  4147.6 1825.0
## - GDP                 1      3.5  4147.7 1825.0
## - `Adult Mortality`   1      3.6  4147.8 1825.0
## - `Hepatitis B`       1      4.7  4148.9 1825.5
## <none>                4144.2 1825.6
## - `Income composition of resources` 1     7.7  4151.9 1826.7
## - `thinness 5-9 years` 1     12.3  4156.5 1828.5
## - Alcohol             1     12.5  4156.7 1828.6
## - `infant deaths`     1     28.3  4172.5 1834.8
## - `under-five deaths` 1     32.1  4176.3 1836.3
## - Schooling           1     37.7  4181.9 1838.6
## - Year                1    460.0  4604.1 1997.2
## - `HIV/AIDS`          1    1019.8  5163.9 2186.4
## - Country             132   16240.4 20384.6 4188.6
##
## Step:  AIC=1823.68
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
##              Df Sum of Sq      RSS      AIC
## - Diphtheria      1      0.1  4144.5 1821.7
## - Population      1      0.2  4144.6 1821.8
## - `thinness 1-19 years` 1      0.4  4144.8 1821.9
## - BMI             1      0.5  4144.8 1821.9
## - `Total expenditure` 1      1.8  4146.1 1822.4
## - `percentage expenditure` 1     2.0  4146.3 1822.5
## - Measles         1      2.8  4147.2 1822.8
## - log(GDP)        1      3.4  4147.8 1823.0
## - GDP             1      3.4  4147.8 1823.1
## - `Adult Mortality` 1      3.6  4148.0 1823.1
## - `Hepatitis B`    1      4.6  4149.0 1823.5
## <none>            4144.4 1823.7
## - `Income composition of resources` 1     7.8  4152.1 1824.8
## - `thinness 5-9 years` 1     12.4  4156.8 1826.6
## - Alcohol         1     12.4  4156.8 1826.6
## - `infant deaths` 1     28.5  4172.8 1833.0
## - `under-five deaths` 1     32.3  4176.6 1834.5
## - Schooling       1     37.6  4182.0 1836.6
## - Year            1    460.0  4604.3 1995.2
## - `HIV/AIDS`      1    1019.6  5164.0 2184.4
## - Country         132   16258.6 20403.0 4188.1

```

```
##
## Step: AIC=1821.73
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + Population + `thinness 1-19 years` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling + log(GDP)
##
##              Df Sum of Sq      RSS      AIC
## - Population      1         0.2  4144.7 1819.8
## - `thinness 1-19 years` 1         0.4  4144.9 1819.9
## - BMI              1         0.5  4145.0 1819.9
## - `Total expenditure` 1         1.8  4146.2 1820.4
## - `percentage expenditure` 1         2.0  4146.4 1820.5
## - Measles          1         2.8  4147.3 1820.8
## - log(GDP)          1         3.4  4147.9 1821.1
## - GDP              1         3.4  4147.9 1821.1
## - `Adult Mortality` 1         3.6  4148.1 1821.2
## <none>                                4144.5 1821.7
## - `Hepatitis B`      1         6.9  4151.3 1822.5
## - `Income composition of resources` 1         8.0  4152.5 1822.9
## - `thinness 5-9 years` 1        12.4  4156.9 1824.7
## - Alcohol            1        12.4  4156.9 1824.7
## - `infant deaths`    1        28.8  4173.3 1831.1
## - `under-five deaths` 1        32.6  4177.1 1832.7
## - Schooling           1        37.8  4182.3 1834.7
## - Year                1       460.4  4604.8 1993.4
## - `HIV/AIDS`         1       1023.3  5167.8 2183.6
## - Country            132     16382.1 20526.6 4196.0
##
## Step: AIC=1819.82
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + `thinness 1-19 years` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##              Df Sum of Sq      RSS      AIC
## - `thinness 1-19 years` 1         0.4  4145.1 1818.0
## - BMI                  1         0.5  4145.2 1818.0
## - `Total expenditure` 1         1.8  4146.4 1818.5
## - `percentage expenditure` 1         2.0  4146.7 1818.6
## - Measles              1         2.9  4147.6 1819.0
## - GDP                  1         3.5  4148.2 1819.2
## - log(GDP)             1         3.5  4148.2 1819.2
## - `Adult Mortality`    1         3.6  4148.3 1819.3
## <none>                                4144.7 1819.8
## - `Hepatitis B`        1         6.8  4151.5 1820.5
## - `Income composition of resources` 1         8.0  4152.7 1821.0
## - Alcohol              1        12.5  4157.2 1822.8
## - `thinness 5-9 years` 1        12.7  4157.4 1822.9
```

```

## - `infant deaths` 1 29.6 4174.3 1829.6
## - `under-five deaths` 1 33.1 4177.8 1830.9
## - Schooling 1 37.7 4182.4 1832.7
## - Year 1 460.2 4604.9 1991.4
## - `HIV/AIDS` 1 1024.6 5169.3 2182.1
## - Country 132 16383.5 20528.2 4194.2
##
## Step: AIC=1817.98
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
## BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + `thinness 5-9 years` + `Income composition of resources` +
## Schooling + log(GDP)
##
## Df Sum of Sq RSS AIC
## - BMI 1 0.5 4145.6 1816.2
## - `Total expenditure` 1 1.8 4146.9 1816.7
## - `percentage expenditure` 1 2.0 4147.1 1816.8
## - Measles 1 2.9 4148.0 1817.1
## - log(GDP) 1 3.4 4148.5 1817.3
## - GDP 1 3.4 4148.5 1817.3
## - `Adult Mortality` 1 3.7 4148.8 1817.4
## <none> 4145.1 1818.0
## - `Hepatitis B` 1 6.9 4152.0 1818.7
## - `Income composition of resources` 1 8.0 4153.1 1819.2
## - Alcohol 1 12.4 4157.5 1820.9
## - `thinness 5-9 years` 1 22.7 4167.8 1825.0
## - `infant deaths` 1 29.4 4174.5 1827.6
## - `under-five deaths` 1 32.8 4177.9 1829.0
## - Schooling 1 37.5 4182.6 1830.8
## - Year 1 459.8 4604.9 1989.5
## - `HIV/AIDS` 1 1024.4 5169.5 2180.2
## - Country 132 16383.8 20528.9 4192.2
##
## Step: AIC=1816.17
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
## `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + `thinness 5-9 years` + `Income composition of resources` +
## Schooling + log(GDP)
##
## Df Sum of Sq RSS AIC
## - `Total expenditure` 1 1.7 4147.2 1814.8
## - `percentage expenditure` 1 2.1 4147.7 1815.0
## - Measles 1 2.9 4148.5 1815.3
## - log(GDP) 1 3.4 4149.0 1815.5
## - GDP 1 3.6 4149.2 1815.6
## - `Adult Mortality` 1 3.7 4149.2 1815.6
## <none> 4145.6 1816.2
## - `Hepatitis B` 1 6.7 4152.3 1816.8
## - `Income composition of resources` 1 7.8 4153.4 1817.3
## - Alcohol 1 12.4 4158.0 1819.1

```



```

## - `thinness 5-9 years`      1      22.8  4168.4 1823.2
## - `infant deaths`          1      29.4  4175.0 1825.8
## - `under-five deaths`      1      32.8  4178.4 1827.2
## - Schooling                 1      37.6  4183.1 1829.0
## - Year                      1     460.2  4605.8 1987.8
## - `HIV/AIDS`               1    1029.2  5174.7 2179.8
## - Country                   132   16644.6 20790.2 4211.1
##
## Step: AIC=1814.83
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   `under-five deaths` + `HIV/AIDS` + GDP + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling + log(GDP)
##
##                                     Df Sum of Sq      RSS      AIC
## - `percentage expenditure`          1         2.2  4149.4 1813.7
## - Measles                          1         2.8  4150.0 1813.9
## - log(GDP)                         1         3.6  4150.8 1814.3
## - `Adult Mortality`                1         3.7  4150.9 1814.3
## - GDP                             1         3.7  4150.9 1814.3
## <none>                             4147.2 1814.8
## - `Hepatitis B`                    1         6.5  4153.7 1815.4
## - `Income composition of resources` 1         7.9  4155.1 1816.0
## - Alcohol                          1        12.3  4159.6 1817.7
## - `thinness 5-9 years`              1        22.7  4170.0 1821.8
## - `infant deaths`                  1        29.5  4176.7 1824.5
## - `under-five deaths`              1        32.9  4180.2 1825.9
## - Schooling                        1        37.7  4185.0 1827.8
## - Year                             1       458.6  4605.8 1985.8
## - `HIV/AIDS`                      1     1027.5  5174.7 2177.8
## - Country                          132   16735.1 20882.3 4216.4
##
## Step: AIC=1813.71
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##                                     Df Sum of Sq      RSS      AIC
## - GDP                             1         2.5  4152.0 1812.7
## - log(GDP)                        1         2.6  4152.1 1812.7
## - Measles                         1         2.8  4152.2 1812.8
## - `Adult Mortality`               1         3.7  4153.1 1813.2
## <none>                             4149.4 1813.7
## - `Hepatitis B`                   1         6.7  4156.1 1814.3
## - `Income composition of resources` 1         7.9  4157.3 1814.8
## - Alcohol                         1        12.0  4161.4 1816.5
## - `thinness 5-9 years`             1        22.6  4172.0 1820.6
## - `infant deaths`                 1        29.0  4178.5 1823.2
## - `under-five deaths`             1        32.5  4181.9 1824.6
## - Schooling                       1        38.4  4187.9 1826.9
## - Year                             1     460.3  4609.8 1985.2

```

```

## - `HIV/AIDS`          1      1025.4   5174.8 2175.9
## - Country              132     16841.6 20991.0 4222.9
##
## Step:  AIC=1812.71
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##                                Df Sum of Sq      RSS      AIC
## - log(GDP)                    1         0.9  4152.9 1811.1
## - Measles                     1         2.8  4154.8 1811.8
## - `Adult Mortality`          1         3.8  4155.7 1812.2
## <none>                        4152.0 1812.7
## - `Hepatitis B`              1         6.6  4158.5 1813.3
## - `Income composition of resources` 1         7.5  4159.5 1813.7
## - Alcohol                    1        11.8  4163.8 1815.4
## - `thinness 5-9 years`       1        22.4  4174.4 1819.6
## - `infant deaths`           1        29.0  4180.9 1822.2
## - `under-five deaths`       1        32.3  4184.3 1823.5
## - Schooling                  1        37.2  4189.2 1825.4
## - Year                      1       473.2  4625.2 1988.7
## - `HIV/AIDS`                1       1022.9  5174.9 2173.9
## - Country                   132     17153.1 21305.1 4245.4
##
## Step:  AIC=1811.06
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##                                Df Sum of Sq      RSS      AIC
## - Measles                     1         2.9  4155.7 1810.2
## - `Adult Mortality`          1         3.9  4156.8 1810.6
## <none>                        4152.9 1811.1
## - `Hepatitis B`              1         6.7  4159.6 1811.7
## - `Income composition of resources` 1         7.6  4160.4 1812.1
## - Alcohol                    1        12.2  4165.0 1813.9
## - `thinness 5-9 years`       1        22.2  4175.1 1817.9
## - `infant deaths`           1        29.1  4181.9 1820.6
## - `under-five deaths`       1        32.4  4185.2 1821.9
## - Schooling                  1        37.2  4190.0 1823.8
## - Year                      1       481.7  4634.5 1990.0
## - `HIV/AIDS`                1       1022.7  5175.5 2172.1
## - Country                   132     18014.7 22167.6 4308.9
##
## Step:  AIC=1810.2
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + `under-five deaths` + `HIV/AIDS` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##

```

```
##
## - `Adult Mortality`
## <none>
## - `Hepatitis B`
## - `Income composition of resources`
## - Alcohol
## - `thinness 5-9 years`
## - `infant deaths`
## - `under-five deaths`
## - Schooling
## - Year
## - `HIV/AIDS`
## - Country
##
## Step: AIC=1809.74
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `Hepatitis B` + `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##           Df Sum of Sq    RSS    AIC
## <none>                4159.6 1809.7
## - `Hepatitis B`       1      6.6 4166.2 1810.3
## - `Income composition of resources` 1      7.7 4167.3 1810.8
## - Alcohol            1     12.3 4171.9 1812.6
## - `thinness 5-9 years` 1     22.9 4182.5 1816.8
## - `infant deaths`     1     27.4 4187.0 1818.6
## - `under-five deaths` 1     30.8 4190.4 1819.9
## - Schooling           1     38.6 4198.2 1823.0
## - Year                1    489.2 4648.8 1991.1
## - `HIV/AIDS`          1    1071.3 5230.9 2185.6
## - Country            132   22622.6 26782.2 4616.7
```

```
tranform_mod_2_back_aic = step(log_transform_2, direction = "backward")
```

```
## Start: AIC=1825.61
## `Life expectancy` ~ Country + Year + Status + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
## Step: AIC=1825.61
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
```

	Df	Sum of Sq	RSS	AIC
## - Polio	1	0.2	4144.4	1823.7
## - Diphtheria	1	0.2	4144.4	1823.7
## - Population	1	0.2	4144.4	1823.7
## - BMI	1	0.5	4144.7	1823.8
## - `thinness 1-19 years`	1	0.5	4144.7	1823.8
## - `Total expenditure`	1	1.8	4145.9	1824.3
## - `percentage expenditure`	1	2.0	4146.2	1824.4
## - Measles	1	2.8	4147.0	1824.7
## - log(GDP)	1	3.4	4147.6	1825.0
## - GDP	1	3.5	4147.7	1825.0
## - `Adult Mortality`	1	3.6	4147.8	1825.0
## - `Hepatitis B`	1	4.7	4148.9	1825.5
## <none>			4144.2	1825.6
## - `Income composition of resources`	1	7.7	4151.9	1826.7
## - `thinness 5-9 years`	1	12.3	4156.5	1828.5
## - Alcohol	1	12.5	4156.7	1828.6
## - `infant deaths`	1	28.3	4172.5	1834.8
## - `under-five deaths`	1	32.1	4176.3	1836.3
## - Schooling	1	37.7	4181.9	1838.6
## - Year	1	460.0	4604.1	1997.2
## - `HIV/AIDS`	1	1019.8	5163.9	2186.4
## - Country	132	16240.4	20384.6	4188.6

```
##
## Step: AIC=1823.68
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
```

	Df	Sum of Sq	RSS	AIC
## - Diphtheria	1	0.1	4144.5	1821.7
## - Population	1	0.2	4144.6	1821.8

```

## - `thinness 1-19 years`      1      0.4  4144.8 1821.9
## - BMI                        1      0.5  4144.8 1821.9
## - `Total expenditure`      1      1.8  4146.1 1822.4
## - `percentage expenditure`  1      2.0  4146.3 1822.5
## - Measles                   1      2.8  4147.2 1822.8
## - log(GDP)                  1      3.4  4147.8 1823.0
## - GDP                       1      3.4  4147.8 1823.1
## - `Adult Mortality`        1      3.6  4148.0 1823.1
## - `Hepatitis B`            1      4.6  4149.0 1823.5
## <none>                      4144.4 1823.7
## - `Income composition of resources` 1      7.8  4152.1 1824.8
## - `thinness 5-9 years`      1     12.4  4156.8 1826.6
## - Alcohol                   1     12.4  4156.8 1826.6
## - `infant deaths`          1     28.5  4172.8 1833.0
## - `under-five deaths`      1     32.3  4176.6 1834.5
## - Schooling                 1     37.6  4182.0 1836.6
## - Year                      1    460.0  4604.3 1995.2
## - `HIV/AIDS`               1    1019.6  5164.0 2184.4
## - Country                   132   16258.6 20403.0 4188.1
##
## Step: AIC=1821.73
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + Population + `thinness 1-19 years` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling + log(GDP)
##
##                                     Df Sum of Sq      RSS      AIC
## - Population                      1      0.2  4144.7 1819.8
## - `thinness 1-19 years`           1      0.4  4144.9 1819.9
## - BMI                             1      0.5  4145.0 1819.9
## - `Total expenditure`             1      1.8  4146.2 1820.4
## - `percentage expenditure`        1      2.0  4146.4 1820.5
## - Measles                        1      2.8  4147.3 1820.8
## - log(GDP)                       1      3.4  4147.9 1821.1
## - GDP                           1      3.4  4147.9 1821.1
## - `Adult Mortality`              1      3.6  4148.1 1821.2
## <none>                           4144.5 1821.7
## - `Hepatitis B`                  1      6.9  4151.3 1822.5
## - `Income composition of resources` 1      8.0  4152.5 1822.9
## - `thinness 5-9 years`           1     12.4  4156.9 1824.7
## - Alcohol                       1     12.4  4156.9 1824.7
## - `infant deaths`                1     28.8  4173.3 1831.1
## - `under-five deaths`            1     32.6  4177.1 1832.7
## - Schooling                     1     37.8  4182.3 1834.7
## - Year                          1    460.4  4604.8 1993.4
## - `HIV/AIDS`                    1    1023.3  5167.8 2183.6
## - Country                       132   16382.1 20526.6 4196.0
##
## Step: AIC=1819.82
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +

```

```
## BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + `thinness 1-19 years` + `thinness 5-9 years` + `Income composition of resources` +
## Schooling + log(GDP)
##
##
## Df Sum of Sq RSS AIC
## - `thinness 1-19 years` 1 0.4 4145.1 1818.0
## - BMI 1 0.5 4145.2 1818.0
## - `Total expenditure` 1 1.8 4146.4 1818.5
## - `percentage expenditure` 1 2.0 4146.7 1818.6
## - Measles 1 2.9 4147.6 1819.0
## - GDP 1 3.5 4148.2 1819.2
## - log(GDP) 1 3.5 4148.2 1819.2
## - `Adult Mortality` 1 3.6 4148.3 1819.3
## <none> 4144.7 1819.8
## - `Hepatitis B` 1 6.8 4151.5 1820.5
## - `Income composition of resources` 1 8.0 4152.7 1821.0
## - Alcohol 1 12.5 4157.2 1822.8
## - `thinness 5-9 years` 1 12.7 4157.4 1822.9
## - `infant deaths` 1 29.6 4174.3 1829.6
## - `under-five deaths` 1 33.1 4177.8 1830.9
## - Schooling 1 37.7 4182.4 1832.7
## - Year 1 460.2 4604.9 1991.4
## - `HIV/AIDS` 1 1024.6 5169.3 2182.1
## - Country 132 16383.5 20528.2 4194.2
##
## Step: AIC=1817.98
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
## BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + `thinness 5-9 years` + `Income composition of resources` +
## Schooling + log(GDP)
##
## Df Sum of Sq RSS AIC
## - BMI 1 0.5 4145.6 1816.2
## - `Total expenditure` 1 1.8 4146.9 1816.7
## - `percentage expenditure` 1 2.0 4147.1 1816.8
## - Measles 1 2.9 4148.0 1817.1
## - log(GDP) 1 3.4 4148.5 1817.3
## - GDP 1 3.4 4148.5 1817.3
## - `Adult Mortality` 1 3.7 4148.8 1817.4
## <none> 4145.1 1818.0
## - `Hepatitis B` 1 6.9 4152.0 1818.7
## - `Income composition of resources` 1 8.0 4153.1 1819.2
## - Alcohol 1 12.4 4157.5 1820.9
## - `thinness 5-9 years` 1 22.7 4167.8 1825.0
## - `infant deaths` 1 29.4 4174.5 1827.6
## - `under-five deaths` 1 32.8 4177.9 1829.0
## - Schooling 1 37.5 4182.6 1830.8
## - Year 1 459.8 4604.9 1989.5
## - `HIV/AIDS` 1 1024.4 5169.5 2180.2
## - Country 132 16383.8 20528.9 4192.2
```

```
##
## Step: AIC=1816.17
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##           Df Sum of Sq    RSS    AIC
## - `Total expenditure`      1      1.7 4147.2 1814.8
## - `percentage expenditure`  1      2.1 4147.7 1815.0
## - Measles                   1      2.9 4148.5 1815.3
## - log(GDP)                  1      3.4 4149.0 1815.5
## - GDP                       1      3.6 4149.2 1815.6
## - `Adult Mortality`        1      3.7 4149.2 1815.6
## <none>                      4145.6 1816.2
## - `Hepatitis B`            1      6.7 4152.3 1816.8
## - `Income composition of resources` 1      7.8 4153.4 1817.3
## - Alcohol                   1     12.4 4158.0 1819.1
## - `thinness 5-9 years`      1     22.8 4168.4 1823.2
## - `infant deaths`           1     29.4 4175.0 1825.8
## - `under-five deaths`       1     32.8 4178.4 1827.2
## - Schooling                  1     37.6 4183.1 1829.0
## - Year                       1    460.2 4605.8 1987.8
## - `HIV/AIDS`                1   1029.2 5174.7 2179.8
## - Country                   132  16644.6 20790.2 4211.1
##
## Step: AIC=1814.83
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   `under-five deaths` + `HIV/AIDS` + GDP + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling + log(GDP)
##
##           Df Sum of Sq    RSS    AIC
## - `percentage expenditure`      1      2.2 4149.4 1813.7
## - Measles                       1      2.8 4150.0 1813.9
## - log(GDP)                      1      3.6 4150.8 1814.3
## - `Adult Mortality`             1      3.7 4150.9 1814.3
## - GDP                           1      3.7 4150.9 1814.3
## <none>                           4147.2 1814.8
## - `Hepatitis B`                 1      6.5 4153.7 1815.4
## - `Income composition of resources` 1      7.9 4155.1 1816.0
## - Alcohol                       1     12.3 4159.6 1817.7
## - `thinness 5-9 years`           1     22.7 4170.0 1821.8
## - `infant deaths`               1     29.5 4176.7 1824.5
## - `under-five deaths`           1     32.9 4180.2 1825.9
## - Schooling                     1     37.7 4185.0 1827.8
## - Year                         1    458.6 4605.8 1985.8
## - `HIV/AIDS`                   1   1027.5 5174.7 2177.8
## - Country                       132  16735.1 20882.3 4216.4
##
## Step: AIC=1813.71
```

```

## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
##           Df Sum of Sq      RSS      AIC
## - GDP           1         2.5  4152.0  1812.7
## - log(GDP)       1         2.6  4152.1  1812.7
## - Measles        1         2.8  4152.2  1812.8
## - `Adult Mortality` 1         3.7  4153.1  1813.2
## <none>                                4149.4  1813.7
## - `Hepatitis B`       1         6.7  4156.1  1814.3
## - `Income composition of resources` 1         7.9  4157.3  1814.8
## - Alcohol            1        12.0  4161.4  1816.5
## - `thinness 5-9 years` 1        22.6  4172.0  1820.6
## - `infant deaths`     1        29.0  4178.5  1823.2
## - `under-five deaths` 1        32.5  4181.9  1824.6
## - Schooling           1        38.4  4187.9  1826.9
## - Year                1       460.3  4609.8  1985.2
## - `HIV/AIDS`          1       1025.4  5174.8  2175.9
## - Country            132     16841.6 20991.0  4222.9
##
## Step:  AIC=1812.71
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
##           Df Sum of Sq      RSS      AIC
## - log(GDP)       1         0.9  4152.9  1811.1
## - Measles         1         2.8  4154.8  1811.8
## - `Adult Mortality` 1         3.8  4155.7  1812.2
## <none>                                4152.0  1812.7
## - `Hepatitis B`       1         6.6  4158.5  1813.3
## - `Income composition of resources` 1         7.5  4159.5  1813.7
## - Alcohol            1        11.8  4163.8  1815.4
## - `thinness 5-9 years` 1        22.4  4174.4  1819.6
## - `infant deaths`     1        29.0  4180.9  1822.2
## - `under-five deaths` 1        32.3  4184.3  1823.5
## - Schooling           1        37.2  4189.2  1825.4
## - Year                1       473.2  4625.2  1988.7
## - `HIV/AIDS`          1       1022.9  5174.9  2173.9
## - Country            132     17153.1 21305.1  4245.4
##
## Step:  AIC=1811.06
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
##           Df Sum of Sq      RSS      AIC
## - Measles         1         2.9  4155.7  1810.2

```



```

## - `Adult Mortality` 1 3.9 4156.8 1810.6
## <none> 4152.9 1811.1
## - `Hepatitis B` 1 6.7 4159.6 1811.7
## - `Income composition of resources` 1 7.6 4160.4 1812.1
## - Alcohol 1 12.2 4165.0 1813.9
## - `thinness 5-9 years` 1 22.2 4175.1 1817.9
## - `infant deaths` 1 29.1 4181.9 1820.6
## - `under-five deaths` 1 32.4 4185.2 1821.9
## - Schooling 1 37.2 4190.0 1823.8
## - Year 1 481.7 4634.5 1990.0
## - `HIV/AIDS` 1 1022.7 5175.5 2172.1
## - Country 132 18014.7 22167.6 4308.9
##
## Step: AIC=1810.2
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `Hepatitis B` + `under-five deaths` + `HIV/AIDS` +
## `thinness 5-9 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - `Adult Mortality` 1 3.9 4159.6 1809.7
## <none> 4155.7 1810.2
## - `Hepatitis B` 1 6.8 4162.5 1810.9
## - `Income composition of resources` 1 7.5 4163.2 1811.2
## - Alcohol 1 12.2 4167.9 1813.0
## - `thinness 5-9 years` 1 22.8 4178.5 1817.2
## - `infant deaths` 1 27.4 4183.2 1819.0
## - `under-five deaths` 1 31.0 4186.7 1820.4
## - Schooling 1 38.3 4194.0 1823.3
## - Year 1 482.8 4638.5 1989.4
## - `HIV/AIDS` 1 1021.8 5177.5 2170.7
## - Country 132 18052.6 22208.3 4309.9
##
## Step: AIC=1809.74
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
## `Hepatitis B` + `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
## `Income composition of resources` + Schooling
##
## Df Sum of Sq RSS AIC
## <none> 4159.6 1809.7
## - `Hepatitis B` 1 6.6 4166.2 1810.3
## - `Income composition of resources` 1 7.7 4167.3 1810.8
## - Alcohol 1 12.3 4171.9 1812.6
## - `thinness 5-9 years` 1 22.9 4182.5 1816.8
## - `infant deaths` 1 27.4 4187.0 1818.6
## - `under-five deaths` 1 30.8 4190.4 1819.9
## - Schooling 1 38.6 4198.2 1823.0
## - Year 1 489.2 4648.8 1991.1
## - `HIV/AIDS` 1 1071.3 5230.9 2185.6
## - Country 132 22622.6 26782.2 4616.7

```

```
tranform_mod_3_back_aic = step(log_transform_3, direction = "backward")
```

```
## Start: AIC=1826.98
## `Life expectancy` ~ Country + Year + Status + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(Population)
##
##
## Step: AIC=1826.98
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(Population)
##
##
```

	Df	Sum of Sq	RSS	AIC
## - log(Population)	1	0.0	4147.6	1825.0
## - Polio	1	0.1	4147.8	1825.0
## - Diphtheria	1	0.2	4147.9	1825.1
## - Population	1	0.3	4147.9	1825.1
## - `thinness 1-19 years`	1	0.3	4147.9	1825.1
## - BMI	1	0.5	4148.1	1825.2
## - `percentage expenditure`	1	1.1	4148.7	1825.4
## - GDP	1	1.6	4149.3	1825.6
## - `Total expenditure`	1	1.9	4149.5	1825.7
## - Measles	1	2.8	4150.5	1826.1
## - `Adult Mortality`	1	3.9	4151.6	1826.5
## - `Hepatitis B`	1	4.8	4152.4	1826.9
## <none>			4147.6	1827.0
## - `Income composition of resources`	1	7.6	4155.2	1828.0
## - `thinness 5-9 years`	1	12.5	4160.1	1829.9
## - Alcohol	1	12.8	4160.4	1830.1
## - `infant deaths`	1	28.4	4176.0	1836.2
## - `under-five deaths`	1	32.0	4179.6	1837.7
## - Schooling	1	36.9	4184.5	1839.6
## - Year	1	455.0	4602.6	1996.6
## - `HIV/AIDS`	1	1015.7	5163.3	2186.2
## - Country	132	16446.2	20593.8	4205.4

```
##
## Step: AIC=1824.98
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
```

	Df	Sum of Sq	RSS	AIC
## - Polio	1	0.1	4147.8	1823.0
## - Diphtheria	1	0.2	4147.9	1823.1

```

## - Population 1 0.3 4147.9 1823.1
## - `thinness 1-19 years` 1 0.3 4148.0 1823.1
## - BMI 1 0.5 4148.1 1823.2
## - `percentage expenditure` 1 1.1 4148.7 1823.4
## - GDP 1 1.6 4149.3 1823.6
## - `Total expenditure` 1 1.9 4149.6 1823.7
## - Measles 1 2.8 4150.5 1824.1
## - `Adult Mortality` 1 3.9 4151.6 1824.5
## - `Hepatitis B` 1 4.8 4152.4 1824.9
## <none> 4147.6 1825.0
## - `Income composition of resources` 1 7.6 4155.2 1826.0
## - `thinness 5-9 years` 1 12.5 4160.1 1827.9
## - Alcohol 1 12.8 4160.4 1828.1
## - `infant deaths` 1 28.4 4176.1 1834.2
## - `under-five deaths` 1 32.1 4179.7 1835.7
## - Schooling 1 37.0 4184.6 1837.6
## - Year 1 456.5 4604.1 1995.2
## - `HIV/AIDS` 1 1016.8 5164.4 2184.5
## - Country 132 16527.0 20674.7 4209.9
##
## Step: AIC=1823.04
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
## BMI + `under-five deaths` + `Total expenditure` + Diphtheria +
## `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
## `thinness 5-9 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - Diphtheria 1 0.2 4147.9 1821.1
## - Population 1 0.3 4148.0 1821.2
## - `thinness 1-19 years` 1 0.3 4148.1 1821.2
## - BMI 1 0.5 4148.3 1821.2
## - `percentage expenditure` 1 1.1 4148.8 1821.5
## - GDP 1 1.6 4149.4 1821.7
## - `Total expenditure` 1 2.0 4149.7 1821.8
## - Measles 1 2.9 4150.6 1822.2
## - `Adult Mortality` 1 3.9 4151.7 1822.6
## - `Hepatitis B` 1 4.7 4152.4 1822.9
## <none> 4147.8 1823.0
## - `Income composition of resources` 1 7.6 4155.4 1824.1
## - `thinness 5-9 years` 1 12.6 4160.3 1826.0
## - Alcohol 1 12.8 4160.5 1826.1
## - `infant deaths` 1 28.6 4176.4 1832.4
## - `under-five deaths` 1 32.2 4180.0 1833.8
## - Schooling 1 36.9 4184.7 1835.6
## - Year 1 456.6 4604.4 1993.2
## - `HIV/AIDS` 1 1016.7 5164.4 2182.5
## - Country 132 16542.4 20690.1 4209.1
##
## Step: AIC=1821.1
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +

```

```

##      Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##      BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##      GDP + Population + `thinness 1-19 years` + `thinness 5-9 years` +
##      `Income composition of resources` + Schooling
##
##
##              Df Sum of Sq      RSS      AIC
## - Population          1          0.3  4148.2  1819.2
## - `thinness 1-19 years` 1          0.3  4148.2  1819.2
## - BMI                  1          0.5  4148.4  1819.3
## - `percentage expenditure` 1          1.1  4149.0  1819.5
## - GDP                  1          1.6  4149.5  1819.7
## - `Total expenditure`  1          2.0  4149.9  1819.9
## - Measles              1          2.8  4150.8  1820.2
## - `Adult Mortality`    1          3.9  4151.8  1820.7
## <none>                  4147.9  1821.1
## - `Hepatitis B`        1          7.1  4155.0  1821.9
## - `Income composition of resources` 1          7.9  4155.8  1822.2
## - `thinness 5-9 years` 1         12.6  4160.5  1824.1
## - Alcohol              1         12.8  4160.7  1824.2
## - `infant deaths`      1         28.9  4176.9  1830.6
## - `under-five deaths`  1         32.6  4180.5  1832.0
## - Schooling            1         37.1  4185.0  1833.8
## - Year                 1        456.9  4604.9  1991.4
## - `HIV/AIDS`           1       1020.4  5168.3  2181.8
## - Country              132     16656.3 20804.2  4216.2
##
## Step:  AIC=1819.21
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##      Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##      BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##      GDP + `thinness 1-19 years` + `thinness 5-9 years` + `Income composition of resources` +
##      Schooling
##
##
##              Df Sum of Sq      RSS      AIC
## - `thinness 1-19 years` 1          0.3  4148.5  1817.3
## - BMI                  1          0.5  4148.7  1817.4
## - `percentage expenditure` 1          1.1  4149.3  1817.6
## - GDP                  1          1.6  4149.8  1817.9
## - `Total expenditure`  1          1.9  4150.1  1818.0
## - Measles              1          3.0  4151.2  1818.4
## - `Adult Mortality`    1          4.0  4152.2  1818.8
## <none>                  4148.2  1819.2
## - `Hepatitis B`        1          7.0  4155.2  1820.0
## - `Income composition of resources` 1          7.9  4156.1  1820.4
## - Alcohol              1         12.9  4161.1  1822.3
## - `thinness 5-9 years` 1         12.9  4161.1  1822.3
## - `infant deaths`      1         29.6  4177.8  1828.9
## - `under-five deaths`  1         32.9  4181.1  1830.2
## - Schooling            1         36.9  4185.1  1831.8
## - Year                 1        456.7  4604.9  1989.4
## - `HIV/AIDS`           1       1021.7  5169.9  2180.3

```

```

## - Country                132    16656.9 20805.1 4214.3
##
## Step:  AIC=1817.32
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##                                Df Sum of Sq    RSS    AIC
## - BMI                        1         0.5  4149.0 1815.5
## - `percentage expenditure`    1         1.1  4149.5 1815.7
## - GDP                        1         1.6  4150.1 1816.0
## - `Total expenditure`        1         1.9  4150.4 1816.1
## - Measles                    1         2.9  4151.4 1816.5
## - `Adult Mortality`         1         4.0  4152.5 1816.9
## <none>                      4148.5 1817.3
## - `Hepatitis B`             1         7.1  4155.6 1818.1
## - `Income composition of resources` 1         7.9  4156.4 1818.5
## - Alcohol                   1        12.8  4161.3 1820.4
## - `thinness 5-9 years`      1        22.2  4170.7 1824.1
## - `infant deaths`          1        29.4  4177.9 1827.0
## - `under-five deaths`      1        32.7  4181.2 1828.3
## - Schooling                 1        36.8  4185.3 1829.9
## - Year                      1       456.5  4605.0 1987.5
## - `HIV/AIDS`               1       1021.7  5170.1 2178.4
## - Country                  132    16656.6 20805.1 4212.3
##
## Step:  AIC=1815.52
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##                                Df Sum of Sq    RSS    AIC
## - `percentage expenditure`    1         1.2  4150.2 1814.0
## - GDP                        1         1.7  4150.7 1814.2
## - `Total expenditure`        1         1.8  4150.8 1814.3
## - Measles                    1         3.0  4152.0 1814.7
## - `Adult Mortality`         1         4.0  4153.0 1815.1
## <none>                      4149.0 1815.5
## - `Hepatitis B`             1         6.9  4155.9 1816.3
## - `Income composition of resources` 1         7.7  4156.6 1816.6
## - Alcohol                   1        12.8  4161.8 1818.6
## - `thinness 5-9 years`      1        22.4  4171.4 1822.4
## - `infant deaths`          1        29.4  4178.4 1825.2
## - `under-five deaths`      1        32.7  4181.7 1826.5
## - Schooling                 1        36.8  4185.8 1828.1
## - Year                      1       456.8  4605.8 1985.8
## - `HIV/AIDS`               1       1026.4  5175.4 2178.0
## - Country                  132    16982.3 21131.3 4235.9

```

```
##
## Step: AIC=1813.99
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `Total expenditure` + `HIV/AIDS` + GDP + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##           Df Sum of Sq      RSS      AIC
## - GDP           1         0.9  4151.0  1812.3
## - `Total expenditure` 1         1.9  4152.1  1812.7
## - Measles        1         3.0  4153.2  1813.2
## - `Adult Mortality` 1         4.0  4154.1  1813.6
## <none>                        4150.2  1814.0
## - `Hepatitis B`       1         7.0  4157.2  1814.8
## - `Income composition of resources` 1         7.7  4157.8  1815.0
## - Alcohol            1        12.5  4162.7  1817.0
## - `thinness 5-9 years` 1        22.3  4172.5  1820.8
## - `infant deaths`     1        29.1  4179.2  1823.5
## - `under-five deaths` 1        32.4  4182.5  1824.8
## - Schooling           1        37.5  4187.6  1826.8
## - Year                1       459.9  4610.1  1985.3
## - `HIV/AIDS`         1      1025.3  5175.4  2176.0
## - Country            132     17019.7 21169.8  4236.9
##
## Step: AIC=1812.34
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `Total expenditure` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##           Df Sum of Sq      RSS      AIC
## - `Total expenditure` 1         1.8  4152.9  1811.1
## - Measles            1         3.0  4154.0  1811.5
## - `Adult Mortality`  1         3.9  4155.0  1811.9
## <none>                        4151.0  1812.3
## - `Hepatitis B`       1         6.9  4158.0  1813.1
## - `Income composition of resources` 1         7.5  4158.5  1813.3
## - Alcohol            1        12.3  4163.3  1815.2
## - `thinness 5-9 years` 1        22.3  4173.4  1819.2
## - `infant deaths`     1        29.0  4180.0  1821.8
## - `under-five deaths` 1        32.3  4183.3  1823.1
## - Schooling           1        37.0  4188.0  1825.0
## - Year                1       483.5  4634.5  1992.0
## - `HIV/AIDS`         1      1024.5  5175.5  2174.1
## - Country            132     17885.0 22036.0  4301.0
##
## Step: AIC=1811.06
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
```

```

##                                Df Sum of Sq      RSS      AIC
## - Measles                      1         2.9  4155.7 1810.2
## - `Adult Mortality`            1         3.9  4156.8 1810.6
## <none>                          4152.9 1811.1
## - `Hepatitis B`                1         6.7  4159.6 1811.7
## - `Income composition of resources` 1         7.6  4160.4 1812.1
## - Alcohol                      1        12.2  4165.0 1813.9
## - `thinness 5-9 years`         1        22.2  4175.1 1817.9
## - `infant deaths`              1        29.1  4181.9 1820.6
## - `under-five deaths`          1        32.4  4185.2 1821.9
## - Schooling                    1        37.2  4190.0 1823.8
## - Year                         1       481.7  4634.5 1990.0
## - `HIV/AIDS`                   1      1022.7  5175.5 2172.1
## - Country                      132     18014.7 22167.6 4308.9
##
## Step:  AIC=1810.2
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + `under-five deaths` + `HIV/AIDS` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##                                Df Sum of Sq      RSS      AIC
## - `Adult Mortality`            1         3.9  4159.6 1809.7
## <none>                          4155.7 1810.2
## - `Hepatitis B`                1         6.8  4162.5 1810.9
## - `Income composition of resources` 1         7.5  4163.2 1811.2
## - Alcohol                      1        12.2  4167.9 1813.0
## - `thinness 5-9 years`         1        22.8  4178.5 1817.2
## - `infant deaths`              1        27.4  4183.2 1819.0
## - `under-five deaths`          1        31.0  4186.7 1820.4
## - Schooling                    1        38.3  4194.0 1823.3
## - Year                         1       482.8  4638.5 1989.4
## - `HIV/AIDS`                   1      1021.8  5177.5 2170.7
## - Country                      132     18052.6 22208.3 4309.9
##
## Step:  AIC=1809.74
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `Hepatitis B` + `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##                                Df Sum of Sq      RSS      AIC
## <none>                          4159.6 1809.7
## - `Hepatitis B`                1         6.6  4166.2 1810.3
## - `Income composition of resources` 1         7.7  4167.3 1810.8
## - Alcohol                      1        12.3  4171.9 1812.6
## - `thinness 5-9 years`         1        22.9  4182.5 1816.8
## - `infant deaths`              1        27.4  4187.0 1818.6
## - `under-five deaths`          1        30.8  4190.4 1819.9
## - Schooling                    1        38.6  4198.2 1823.0
## - Year                         1       489.2  4648.8 1991.1
## - `HIV/AIDS`                   1      1071.3  5230.9 2185.6
## - Country                      132     22622.6 26782.2 4616.7

```



```
tranform_mod_1_back_bic = step(log_transform_1, direction = "backward", k = log(n))
```

```
## Start: AIC=2660.43
## `Life expectancy` ~ Country + Year + Status + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(Population) + log(GDP)
##
##
## Step: AIC=2660.43
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(Population) + log(GDP)
##
##
##           Df Sum of Sq    RSS    AIC
## - log(Population)      1      0.0 4144.2 2653.0
## - Polio                 1      0.2 4144.4 2653.1
## - Diphtheria            1      0.2 4144.4 2653.1
## - Population            1      0.2 4144.4 2653.1
## - BMI                   1      0.5 4144.7 2653.2
## - `thinness 1-19 years`  1      0.5 4144.7 2653.2
## - `Total expenditure`   1      1.7 4145.9 2653.7
## - `percentage expenditure` 1      2.0 4146.2 2653.8
## - Measles               1      2.8 4147.0 2654.1
## - log(GDP)              1      3.4 4147.6 2654.4
## - GDP                   1      3.5 4147.7 2654.4
## - `Adult Mortality`     1      3.6 4147.8 2654.5
## - `Hepatitis B`         1      4.8 4148.9 2654.9
## - `Income composition of resources` 1      7.8 4151.9 2656.1
## - `thinness 5-9 years`  1     12.3 4156.5 2657.9
## - Alcohol               1     12.5 4156.6 2658.0
## <none>                  4144.2 2660.4
## - `infant deaths`       1     28.3 4172.4 2664.2
## - `under-five deaths`   1     32.1 4176.3 2665.8
## - Schooling              1     37.7 4181.8 2667.9
## - Year                   1    458.5 4602.6 2826.0
## - `HIV/AIDS`            1    1018.6 5162.8 3015.4
## - Country                132   16162.9 20307.1 4303.3
##
## Step: AIC=2653.03
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
##           Df Sum of Sq    RSS    AIC
## - Polio                 1      0.2 4144.4 2645.7
```

```

## - Diphtheria          1      0.2  4144.4 2645.7
## - Population          1      0.2  4144.4 2645.7
## - BMI                 1      0.5  4144.7 2645.8
## - `thinness 1-19 years` 1      0.5  4144.7 2645.8
## - `Total expenditure`  1      1.8  4145.9 2646.3
## - `percentage expenditure` 1     2.0  4146.2 2646.4
## - Measles             1      2.8  4147.0 2646.7
## - log(GDP)            1      3.4  4147.6 2647.0
## - GDP                 1      3.5  4147.7 2647.0
## - `Adult Mortality`   1      3.6  4147.8 2647.1
## - `Hepatitis B`       1      4.7  4148.9 2647.5
## - `Income composition of resources` 1     7.7  4151.9 2648.7
## - `thinness 5-9 years` 1     12.3  4156.5 2650.5
## - Alcohol             1     12.5  4156.7 2650.6
## <none>                4144.2 2653.0
## - `infant deaths`     1     28.3  4172.5 2656.8
## - `under-five deaths` 1     32.1  4176.3 2658.4
## - Schooling           1     37.7  4181.9 2660.6
## - Year                1    460.0  4604.1 2819.2
## - `HIV/AIDS`          1    1019.8  5163.9 3008.4
## - Country             132   16240.4 20384.6 4302.2
##
## Step:  AIC=2645.69
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
##              Df Sum of Sq      RSS      AIC
## - Diphtheria      1      0.1  4144.5 2638.3
## - Population      1      0.2  4144.6 2638.4
## - `thinness 1-19 years` 1      0.4  4144.8 2638.5
## - BMI             1      0.5  4144.8 2638.5
## - `Total expenditure` 1      1.8  4146.1 2639.0
## - `percentage expenditure` 1     2.0  4146.3 2639.1
## - Measles         1      2.8  4147.2 2639.4
## - log(GDP)        1      3.4  4147.8 2639.6
## - GDP             1      3.4  4147.8 2639.7
## - `Adult Mortality` 1      3.6  4148.0 2639.7
## - `Hepatitis B`    1      4.6  4149.0 2640.1
## - `Income composition of resources` 1     7.8  4152.1 2641.4
## - `thinness 5-9 years` 1     12.4  4156.8 2643.2
## - Alcohol         1     12.4  4156.8 2643.2
## <none>            4144.4 2645.7
## - `infant deaths`  1     28.5  4172.8 2649.6
## - `under-five deaths` 1     32.3  4176.6 2651.1
## - Schooling       1     37.6  4182.0 2653.2
## - Year            1    460.0  4604.3 2811.8
## - `HIV/AIDS`      1    1019.6  5164.0 3001.0
## - Country         132   16258.6 20403.0 4296.2

```

```
##
## Step: AIC=2638.33
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + Population + `thinness 1-19 years` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling + log(GDP)
##
##           Df Sum of Sq      RSS      AIC
## - Population           1         0.2  4144.7  2631.0
## - `thinness 1-19 years` 1         0.4  4144.9  2631.1
## - BMI                   1         0.5  4145.0  2631.1
## - `Total expenditure`  1         1.8  4146.2  2631.6
## - `percentage expenditure` 1         2.0  4146.4  2631.7
## - Measles               1         2.8  4147.3  2632.0
## - log(GDP)              1         3.4  4147.9  2632.3
## - GDP                   1         3.4  4147.9  2632.3
## - `Adult Mortality`    1         3.6  4148.1  2632.3
## - `Hepatitis B`        1         6.9  4151.3  2633.6
## - `Income composition of resources` 1         8.0  4152.5  2634.1
## - `thinness 5-9 years` 1        12.4  4156.9  2635.9
## - Alcohol              1        12.4  4156.9  2635.9
## <none>                                4144.5  2638.3
## - `infant deaths`      1        28.8  4173.3  2642.3
## - `under-five deaths`  1        32.6  4177.1  2643.9
## - Schooling             1        37.8  4182.3  2645.9
## - Year                  1       460.4  4604.8  2804.6
## - `HIV/AIDS`           1       1023.3  5167.8  2994.8
## - Country              132     16382.1 20526.6  4298.8
##
## Step: AIC=2631.01
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + `thinness 1-19 years` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##           Df Sum of Sq      RSS      AIC
## - `thinness 1-19 years` 1         0.4  4145.1  2623.8
## - BMI                   1         0.5  4145.2  2623.8
## - `Total expenditure`  1         1.8  4146.4  2624.3
## - `percentage expenditure` 1         2.0  4146.7  2624.4
## - Measles               1         2.9  4147.6  2624.8
## - GDP                   1         3.5  4148.2  2625.0
## - log(GDP)              1         3.5  4148.2  2625.0
## - `Adult Mortality`    1         3.6  4148.3  2625.0
## - `Hepatitis B`        1         6.8  4151.5  2626.3
## - `Income composition of resources` 1         8.0  4152.7  2626.8
## - Alcohol              1        12.5  4157.2  2628.6
## - `thinness 5-9 years` 1        12.7  4157.4  2628.6
## <none>                                4144.7  2631.0
```

```

## - `infant deaths`      1      29.6  4174.3 2635.3
## - `under-five deaths`  1      33.1  4177.8 2636.7
## - Schooling            1      37.7  4182.4 2638.5
## - Year                 1     460.2  4604.9 2797.2
## - `HIV/AIDS`          1    1024.6  5169.3 2987.9
## - Country              132   16383.5 20528.2 4291.5
##
## Step: AIC=2623.76
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##                                     Df Sum of Sq      RSS      AIC
## - BMI                             1         0.5  4145.6 2616.5
## - `Total expenditure`              1         1.8  4146.9 2617.1
## - `percentage expenditure`         1         2.0  4147.1 2617.1
## - Measles                         1         2.9  4148.0 2617.5
## - log(GDP)                        1         3.4  4148.5 2617.7
## - GDP                             1         3.4  4148.5 2617.7
## - `Adult Mortality`               1         3.7  4148.8 2617.8
## - `Hepatitis B`                   1         6.9  4152.0 2619.1
## - `Income composition of resources` 1         8.0  4153.1 2619.5
## - Alcohol                         1        12.4  4157.5 2621.3
## <none>                             4145.1 2623.8
## - `thinness 5-9 years`            1        22.7  4167.8 2625.3
## - `infant deaths`                 1        29.4  4174.5 2628.0
## - `under-five deaths`             1        32.8  4177.9 2629.4
## - Schooling                       1        37.5  4182.6 2631.2
## - Year                            1       459.8  4604.9 2789.8
## - `HIV/AIDS`                      1    1024.4  5169.5 2980.5
## - Country                         132   16383.8 20528.9 4284.2
##
## Step: AIC=2616.54
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##                                     Df Sum of Sq      RSS      AIC
## - `Total expenditure`              1         1.7  4147.2 2609.8
## - `percentage expenditure`         1         2.1  4147.7 2610.0
## - Measles                         1         2.9  4148.5 2610.3
## - log(GDP)                        1         3.4  4149.0 2610.5
## - GDP                             1         3.6  4149.2 2610.6
## - `Adult Mortality`               1         3.7  4149.2 2610.6
## - `Hepatitis B`                   1         6.7  4152.3 2611.8
## - `Income composition of resources` 1         7.8  4153.4 2612.2
## - Alcohol                         1        12.4  4158.0 2614.1
## <none>                             4145.6 2616.5

```

```

## - `thinness 5-9 years`      1      22.8  4168.4 2618.2
## - `infant deaths`          1      29.4  4175.0 2620.8
## - `under-five deaths`      1      32.8  4178.4 2622.1
## - Schooling                 1      37.6  4183.1 2624.0
## - Year                     1     460.2  4605.8 2782.7
## - `HIV/AIDS`               1    1029.2  5174.7 2974.8
## - Country                  132   16644.6 20790.2 4297.6
##
## Step: AIC=2609.79
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   `under-five deaths` + `HIV/AIDS` + GDP + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling + log(GDP)
##
##                                     Df Sum of Sq      RSS      AIC
## - `percentage expenditure`          1         2.2  4149.4 2603.3
## - Measles                          1         2.8  4150.0 2603.5
## - log(GDP)                         1         3.6  4150.8 2603.8
## - `Adult Mortality`                1         3.7  4150.9 2603.8
## - GDP                             1         3.7  4150.9 2603.9
## - `Hepatitis B`                    1         6.5  4153.7 2605.0
## - `Income composition of resources` 1         7.9  4155.1 2605.5
## - Alcohol                          1        12.3  4159.6 2607.3
## <none>                             4147.2 2609.8
## - `thinness 5-9 years`              1        22.7  4170.0 2611.4
## - `infant deaths`                  1        29.5  4176.7 2614.1
## - `under-five deaths`              1        32.9  4180.2 2615.4
## - Schooling                        1        37.7  4185.0 2617.3
## - Year                             1       458.6  4605.8 2775.3
## - `HIV/AIDS`                       1       1027.5  5174.7 2967.4
## - Country                          132    16735.1 20882.3 4297.5
##
## Step: AIC=2603.26
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##                                     Df Sum of Sq      RSS      AIC
## - GDP                             1         2.5  4152.0 2596.9
## - log(GDP)                         1         2.6  4152.1 2596.9
## - Measles                          1         2.8  4152.2 2597.0
## - `Adult Mortality`                1         3.7  4153.1 2597.3
## - `Hepatitis B`                    1         6.7  4156.1 2598.5
## - `Income composition of resources` 1         7.9  4157.3 2599.0
## - Alcohol                          1        12.0  4161.4 2600.6
## <none>                             4149.4 2603.3
## - `thinness 5-9 years`              1        22.6  4172.0 2604.8
## - `infant deaths`                  1        29.0  4178.5 2607.4
## - `under-five deaths`              1        32.5  4181.9 2608.7
## - Schooling                        1        38.4  4187.9 2611.1
## - Year                             1       460.3  4609.8 2769.3

```

```

## - `HIV/AIDS`      1      1025.4   5174.8 2960.0
## - Country          132     16841.6 20991.0 4298.6
##
## Step:  AIC=2596.86
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##              Df Sum of Sq      RSS      AIC
## - log(GDP)      1         0.9  4152.9 2589.8
## - Measles        1         2.8  4154.8 2590.6
## - `Adult Mortality` 1         3.8  4155.7 2590.9
## - `Hepatitis B`    1         6.6  4158.5 2592.1
## - `Income composition of resources` 1         7.5  4159.5 2592.4
## - Alcohol          1        11.8  4163.8 2594.1
## <none>                                4152.0 2596.9
## - `thinness 5-9 years` 1        22.4  4174.4 2598.3
## - `infant deaths`    1        29.0  4180.9 2600.9
## - `under-five deaths` 1        32.3  4184.3 2602.2
## - Schooling          1        37.2  4189.2 2604.2
## - Year               1       473.2  4625.2 2767.4
## - `HIV/AIDS`        1       1022.9  5174.9 2952.6
## - Country           132     17153.1 21305.1 4315.7
##
## Step:  AIC=2589.8
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##              Df Sum of Sq      RSS      AIC
## - Measles        1         2.9  4155.7 2583.5
## - `Adult Mortality` 1         3.9  4156.8 2584.0
## - `Hepatitis B`    1         6.7  4159.6 2585.1
## - `Income composition of resources` 1         7.6  4160.4 2585.4
## - Alcohol          1        12.2  4165.0 2587.2
## <none>                                4152.9 2589.8
## - `thinness 5-9 years` 1        22.2  4175.1 2591.2
## - `infant deaths`    1        29.1  4181.9 2593.9
## - `under-five deaths` 1        32.4  4185.2 2595.2
## - Schooling          1        37.2  4190.0 2597.1
## - Year               1       481.7  4634.5 2763.3
## - `HIV/AIDS`        1       1022.7  5175.5 2945.4
## - Country           132     18014.7 22167.6 4373.8
##
## Step:  AIC=2583.53
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + `under-five deaths` + `HIV/AIDS` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##

```

```

##                                Df Sum of Sq      RSS      AIC
## - `Adult Mortality`          1         3.9  4159.6  2577.7
## - `Hepatitis B`              1         6.8  4162.5  2578.8
## - `Income composition of resources` 1         7.5  4163.2  2579.1
## - Alcohol                    1        12.2  4167.9  2581.0
## <none>                        4155.7  2583.5
## - `thinness 5-9 years`       1        22.8  4178.5  2585.1
## - `infant deaths`           1        27.4  4183.2  2587.0
## - `under-five deaths`       1        31.0  4186.7  2588.4
## - Schooling                  1        38.3  4194.0  2591.2
## - Year                       1       482.8  4638.5  2757.4
## - `HIV/AIDS`                1      1021.8  5177.5  2938.6
## - Country                   132     18052.6 22208.3  4369.4
##
## Step:  AIC=2577.67
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `Hepatitis B` + `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##                                Df Sum of Sq      RSS      AIC
## - `Hepatitis B`              1         6.6  4166.2  2572.9
## - `Income composition of resources` 1         7.7  4167.3  2573.3
## - Alcohol                    1        12.3  4171.9  2575.1
## <none>                        4159.6  2577.7
## - `thinness 5-9 years`       1        22.9  4182.5  2579.3
## - `infant deaths`           1        27.4  4187.0  2581.1
## - `under-five deaths`       1        30.8  4190.4  2582.4
## - Schooling                  1        38.6  4198.2  2585.5
## - Year                       1       489.2  4648.8  2753.6
## - `HIV/AIDS`                1      1071.3  5230.9  2948.2
## - Country                   132     22622.6 26782.2  4670.8
##
## Step:  AIC=2572.86
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##                                Df Sum of Sq      RSS      AIC
## - `Income composition of resources` 1         7.9  4174.1  2568.6
## - Alcohol                    1        12.1  4178.3  2570.2
## <none>                        4166.2  2572.9
## - `thinness 5-9 years`       1        23.8  4190.0  2574.9
## - `infant deaths`           1        27.3  4193.5  2576.2
## - `under-five deaths`       1        31.2  4197.4  2577.8
## - Schooling                  1        38.7  4204.8  2580.7
## - Year                       1       515.0  4681.2  2757.7
## - `HIV/AIDS`                1      1076.3  5242.5  2944.4
## - Country                   132     22626.1 26792.3  4664.0
##
## Step:  AIC=2568.59
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +

```



```
##      Schooling
##
##              Df Sum of Sq      RSS      AIC
## - Alcohol          1         11.5  4185.6 2565.7
## <none>                                4174.1 2568.6
## - `thinness 5-9 years`  1         24.1  4198.2 2570.7
## - `infant deaths`      1         27.3  4201.4 2571.9
## - `under-five deaths`  1         31.1  4205.2 2573.4
## - Schooling           1         38.5  4212.6 2576.3
## - Year                1        646.6  4820.7 2798.7
## - `HIV/AIDS`          1       1070.3  5244.4 2937.6
## - Country             132     26354.1 30528.2 4871.8
##
## Step:  AIC=2565.72
## `Life expectancy` ~ Country + Year + `infant deaths` + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + Schooling
##
##              Df Sum of Sq      RSS      AIC
## <none>                                4185.6 2565.7
## - `thinness 5-9 years`  1         24.3  4209.9 2567.9
## - `infant deaths`      1         30.8  4216.4 2570.4
## - `under-five deaths`  1         34.4  4220.0 2571.8
## - Schooling           1         37.0  4222.6 2572.8
## - Year                1        686.5  4872.1 2808.7
## - `HIV/AIDS`          1       1099.8  5285.4 2943.0
## - Country             132     26345.0 30530.7 4864.6
```

```
tranform_mod_2_back_bic = step(log_transform_2, direction = "backward", k = log(n))
```

```
## Start: AIC=2653.03
## `Life expectancy` ~ Country + Year + Status + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
## Step: AIC=2653.03
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
```

	Df	Sum of Sq	RSS	AIC
## - Polio	1	0.2	4144.4	2645.7
## - Diphtheria	1	0.2	4144.4	2645.7
## - Population	1	0.2	4144.4	2645.7
## - BMI	1	0.5	4144.7	2645.8
## - `thinness 1-19 years`	1	0.5	4144.7	2645.8
## - `Total expenditure`	1	1.8	4145.9	2646.3
## - `percentage expenditure`	1	2.0	4146.2	2646.4
## - Measles	1	2.8	4147.0	2646.7
## - log(GDP)	1	3.4	4147.6	2647.0
## - GDP	1	3.5	4147.7	2647.0
## - `Adult Mortality`	1	3.6	4147.8	2647.1
## - `Hepatitis B`	1	4.7	4148.9	2647.5
## - `Income composition of resources`	1	7.7	4151.9	2648.7
## - `thinness 5-9 years`	1	12.3	4156.5	2650.5
## - Alcohol	1	12.5	4156.7	2650.6
## <none>			4144.2	2653.0
## - `infant deaths`	1	28.3	4172.5	2656.8
## - `under-five deaths`	1	32.1	4176.3	2658.4
## - Schooling	1	37.7	4181.9	2660.6
## - Year	1	460.0	4604.1	2819.2
## - `HIV/AIDS`	1	1019.8	5163.9	3008.4
## - Country	132	16240.4	20384.6	4302.2

```
##
## Step: AIC=2645.69
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + Diphtheria +
##   `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
```

	Df	Sum of Sq	RSS	AIC
## - Diphtheria	1	0.1	4144.5	2638.3
## - Population	1	0.2	4144.6	2638.4

```

## - `thinness 1-19 years`      1      0.4  4144.8 2638.5
## - BMI                        1      0.5  4144.8 2638.5
## - `Total expenditure`       1      1.8  4146.1 2639.0
## - `percentage expenditure`   1      2.0  4146.3 2639.1
## - Measles                    1      2.8  4147.2 2639.4
## - log(GDP)                   1      3.4  4147.8 2639.6
## - GDP                        1      3.4  4147.8 2639.7
## - `Adult Mortality`         1      3.6  4148.0 2639.7
## - `Hepatitis B`             1      4.6  4149.0 2640.1
## - `Income composition of resources` 1      7.8  4152.1 2641.4
## - `thinness 5-9 years`      1     12.4  4156.8 2643.2
## - Alcohol                    1     12.4  4156.8 2643.2
## <none>                        4144.4 2645.7
## - `infant deaths`           1     28.5  4172.8 2649.6
## - `under-five deaths`       1     32.3  4176.6 2651.1
## - Schooling                  1     37.6  4182.0 2653.2
## - Year                       1    460.0  4604.3 2811.8
## - `HIV/AIDS`                1    1019.6  5164.0 3001.0
## - Country                    132   16258.6 20403.0 4296.2
##
## Step: AIC=2638.33
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + Population + `thinness 1-19 years` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling + log(GDP)
##
##                                     Df Sum of Sq      RSS      AIC
## - Population                       1      0.2  4144.7 2631.0
## - `thinness 1-19 years`            1      0.4  4144.9 2631.1
## - BMI                             1      0.5  4145.0 2631.1
## - `Total expenditure`              1      1.8  4146.2 2631.6
## - `percentage expenditure`         1      2.0  4146.4 2631.7
## - Measles                         1      2.8  4147.3 2632.0
## - log(GDP)                        1      3.4  4147.9 2632.3
## - GDP                             1      3.4  4147.9 2632.3
## - `Adult Mortality`               1      3.6  4148.1 2632.3
## - `Hepatitis B`                   1      6.9  4151.3 2633.6
## - `Income composition of resources` 1      8.0  4152.5 2634.1
## - `thinness 5-9 years`            1     12.4  4156.9 2635.9
## - Alcohol                         1     12.4  4156.9 2635.9
## <none>                             4144.5 2638.3
## - `infant deaths`                 1     28.8  4173.3 2642.3
## - `under-five deaths`             1     32.6  4177.1 2643.9
## - Schooling                       1     37.8  4182.3 2645.9
## - Year                           1    460.4  4604.8 2804.6
## - `HIV/AIDS`                     1    1023.3  5167.8 2994.8
## - Country                         132   16382.1 20526.6 4298.8
##
## Step: AIC=2631.01
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +

```

```
## BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + `thinness 1-19 years` + `thinness 5-9 years` + `Income composition of resources` +
## Schooling + log(GDP)
##
##
## Df Sum of Sq RSS AIC
## - `thinness 1-19 years` 1 0.4 4145.1 2623.8
## - BMI 1 0.5 4145.2 2623.8
## - `Total expenditure` 1 1.8 4146.4 2624.3
## - `percentage expenditure` 1 2.0 4146.7 2624.4
## - Measles 1 2.9 4147.6 2624.8
## - GDP 1 3.5 4148.2 2625.0
## - log(GDP) 1 3.5 4148.2 2625.0
## - `Adult Mortality` 1 3.6 4148.3 2625.0
## - `Hepatitis B` 1 6.8 4151.5 2626.3
## - `Income composition of resources` 1 8.0 4152.7 2626.8
## - Alcohol 1 12.5 4157.2 2628.6
## - `thinness 5-9 years` 1 12.7 4157.4 2628.6
## <none> 4144.7 2631.0
## - `infant deaths` 1 29.6 4174.3 2635.3
## - `under-five deaths` 1 33.1 4177.8 2636.7
## - Schooling 1 37.7 4182.4 2638.5
## - Year 1 460.2 4604.9 2797.2
## - `HIV/AIDS` 1 1024.6 5169.3 2987.9
## - Country 132 16383.5 20528.2 4291.5
##
## Step: AIC=2623.76
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
## BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
## GDP + `thinness 5-9 years` + `Income composition of resources` +
## Schooling + log(GDP)
##
## Df Sum of Sq RSS AIC
## - BMI 1 0.5 4145.6 2616.5
## - `Total expenditure` 1 1.8 4146.9 2617.1
## - `percentage expenditure` 1 2.0 4147.1 2617.1
## - Measles 1 2.9 4148.0 2617.5
## - log(GDP) 1 3.4 4148.5 2617.7
## - GDP 1 3.4 4148.5 2617.7
## - `Adult Mortality` 1 3.7 4148.8 2617.8
## - `Hepatitis B` 1 6.9 4152.0 2619.1
## - `Income composition of resources` 1 8.0 4153.1 2619.5
## - Alcohol 1 12.4 4157.5 2621.3
## <none> 4145.1 2623.8
## - `thinness 5-9 years` 1 22.7 4167.8 2625.3
## - `infant deaths` 1 29.4 4174.5 2628.0
## - `under-five deaths` 1 32.8 4177.9 2629.4
## - Schooling 1 37.5 4182.6 2631.2
## - Year 1 459.8 4604.9 2789.8
## - `HIV/AIDS` 1 1024.4 5169.5 2980.5
## - Country 132 16383.8 20528.9 4284.2
```

```
##
## Step: AIC=2616.54
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##           Df Sum of Sq    RSS    AIC
## - `Total expenditure`      1      1.7 4147.2 2609.8
## - `percentage expenditure`  1      2.1 4147.7 2610.0
## - Measles                   1      2.9 4148.5 2610.3
## - log(GDP)                  1      3.4 4149.0 2610.5
## - GDP                       1      3.6 4149.2 2610.6
## - `Adult Mortality`        1      3.7 4149.2 2610.6
## - `Hepatitis B`            1      6.7 4152.3 2611.8
## - `Income composition of resources` 1      7.8 4153.4 2612.2
## - Alcohol                   1     12.4 4158.0 2614.1
## <none>                      4145.6 2616.5
## - `thinness 5-9 years`      1     22.8 4168.4 2618.2
## - `infant deaths`           1     29.4 4175.0 2620.8
## - `under-five deaths`       1     32.8 4178.4 2622.1
## - Schooling                  1     37.6 4183.1 2624.0
## - Year                       1    460.2 4605.8 2782.7
## - `HIV/AIDS`                1   1029.2 5174.7 2974.8
## - Country                   132  16644.6 20790.2 4297.6
##
## Step: AIC=2609.79
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   `under-five deaths` + `HIV/AIDS` + GDP + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling + log(GDP)
##
##           Df Sum of Sq    RSS    AIC
## - `percentage expenditure`      1      2.2 4149.4 2603.3
## - Measles                       1      2.8 4150.0 2603.5
## - log(GDP)                      1      3.6 4150.8 2603.8
## - `Adult Mortality`             1      3.7 4150.9 2603.8
## - GDP                           1      3.7 4150.9 2603.9
## - `Hepatitis B`                 1      6.5 4153.7 2605.0
## - `Income composition of resources` 1      7.9 4155.1 2605.5
## - Alcohol                       1     12.3 4159.6 2607.3
## <none>                          4147.2 2609.8
## - `thinness 5-9 years`          1     22.7 4170.0 2611.4
## - `infant deaths`               1     29.5 4176.7 2614.1
## - `under-five deaths`           1     32.9 4180.2 2615.4
## - Schooling                     1     37.7 4185.0 2617.3
## - Year                           1    458.6 4605.8 2775.3
## - `HIV/AIDS`                   1   1027.5 5174.7 2967.4
## - Country                       132  16735.1 20882.3 4297.5
##
## Step: AIC=2603.26
```

```

## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
##           Df Sum of Sq      RSS      AIC
## - GDP           1         2.5  4152.0  2596.9
## - log(GDP)       1         2.6  4152.1  2596.9
## - Measles        1         2.8  4152.2  2597.0
## - `Adult Mortality` 1         3.7  4153.1  2597.3
## - `Hepatitis B`    1         6.7  4156.1  2598.5
## - `Income composition of resources` 1         7.9  4157.3  2599.0
## - Alcohol         1        12.0  4161.4  2600.6
## <none>                                4149.4  2603.3
## - `thinness 5-9 years` 1        22.6  4172.0  2604.8
## - `infant deaths`    1        29.0  4178.5  2607.4
## - `under-five deaths` 1        32.5  4181.9  2608.7
## - Schooling         1        38.4  4187.9  2611.1
## - Year              1       460.3  4609.8  2769.3
## - `HIV/AIDS`        1      1025.4  5174.8  2960.0
## - Country          132     16841.6 20991.0  4298.6
##
## Step:  AIC=2596.86
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(GDP)
##
##
##           Df Sum of Sq      RSS      AIC
## - log(GDP)       1         0.9  4152.9  2589.8
## - Measles        1         2.8  4154.8  2590.6
## - `Adult Mortality` 1         3.8  4155.7  2590.9
## - `Hepatitis B`    1         6.6  4158.5  2592.1
## - `Income composition of resources` 1         7.5  4159.5  2592.4
## - Alcohol         1        11.8  4163.8  2594.1
## <none>                                4152.0  2596.9
## - `thinness 5-9 years` 1        22.4  4174.4  2598.3
## - `infant deaths`    1        29.0  4180.9  2600.9
## - `under-five deaths` 1        32.3  4184.3  2602.2
## - Schooling         1        37.2  4189.2  2604.2
## - Year              1       473.2  4625.2  2767.4
## - `HIV/AIDS`        1      1022.9  5174.9  2952.6
## - Country          132     17153.1 21305.1  4315.7
##
## Step:  AIC=2589.8
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
##           Df Sum of Sq      RSS      AIC
## - Measles        1         2.9  4155.7  2583.5

```

```

## - `Adult Mortality` 1 3.9 4156.8 2584.0
## - `Hepatitis B` 1 6.7 4159.6 2585.1
## - `Income composition of resources` 1 7.6 4160.4 2585.4
## - Alcohol 1 12.2 4165.0 2587.2
## <none> 4152.9 2589.8
## - `thinness 5-9 years` 1 22.2 4175.1 2591.2
## - `infant deaths` 1 29.1 4181.9 2593.9
## - `under-five deaths` 1 32.4 4185.2 2595.2
## - Schooling 1 37.2 4190.0 2597.1
## - Year 1 481.7 4634.5 2763.3
## - `HIV/AIDS` 1 1022.7 5175.5 2945.4
## - Country 132 18014.7 22167.6 4373.8
##
## Step: AIC=2583.53
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `Hepatitis B` + `under-five deaths` + `HIV/AIDS` +
## `thinness 5-9 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - `Adult Mortality` 1 3.9 4159.6 2577.7
## - `Hepatitis B` 1 6.8 4162.5 2578.8
## - `Income composition of resources` 1 7.5 4163.2 2579.1
## - Alcohol 1 12.2 4167.9 2581.0
## <none> 4155.7 2583.5
## - `thinness 5-9 years` 1 22.8 4178.5 2585.1
## - `infant deaths` 1 27.4 4183.2 2587.0
## - `under-five deaths` 1 31.0 4186.7 2588.4
## - Schooling 1 38.3 4194.0 2591.2
## - Year 1 482.8 4638.5 2757.4
## - `HIV/AIDS` 1 1021.8 5177.5 2938.6
## - Country 132 18052.6 22208.3 4369.4
##
## Step: AIC=2577.67
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
## `Hepatitis B` + `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
## `Income composition of resources` + Schooling
##
## Df Sum of Sq RSS AIC
## - `Hepatitis B` 1 6.6 4166.2 2572.9
## - `Income composition of resources` 1 7.7 4167.3 2573.3
## - Alcohol 1 12.3 4171.9 2575.1
## <none> 4159.6 2577.7
## - `thinness 5-9 years` 1 22.9 4182.5 2579.3
## - `infant deaths` 1 27.4 4187.0 2581.1
## - `under-five deaths` 1 30.8 4190.4 2582.4
## - Schooling 1 38.6 4198.2 2585.5
## - Year 1 489.2 4648.8 2753.6
## - `HIV/AIDS` 1 1071.3 5230.9 2948.2
## - Country 132 22622.6 26782.2 4670.8
##
## Step: AIC=2572.86

```

```
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##               Df Sum of Sq    RSS    AIC
## - `Income composition of resources` 1      7.9 4174.1 2568.6
## - Alcohol                           1     12.1 4178.3 2570.2
## <none>                               4166.2 2572.9
## - `thinness 5-9 years`               1     23.8 4190.0 2574.9
## - `infant deaths`                   1     27.3 4193.5 2576.2
## - `under-five deaths`               1     31.2 4197.4 2577.8
## - Schooling                         1     38.7 4204.8 2580.7
## - Year                              1    515.0 4681.2 2757.7
## - `HIV/AIDS`                       1   1076.3 5242.5 2944.4
## - Country                          132  22626.1 26792.3 4664.0
##
## Step:  AIC=2568.59
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   Schooling
##
##               Df Sum of Sq    RSS    AIC
## - Alcohol        1      11.5 4185.6 2565.7
## <none>            4174.1 2568.6
## - `thinness 5-9 years` 1     24.1 4198.2 2570.7
## - `infant deaths`     1     27.3 4201.4 2571.9
## - `under-five deaths` 1     31.1 4205.2 2573.4
## - Schooling          1     38.5 4212.6 2576.3
## - Year              1    646.6 4820.7 2798.7
## - `HIV/AIDS`         1   1070.3 5244.4 2937.6
## - Country           132  26354.1 30528.2 4871.8
##
## Step:  AIC=2565.72
## `Life expectancy` ~ Country + Year + `infant deaths` + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + Schooling
##
##               Df Sum of Sq    RSS    AIC
## <none>            4185.6 2565.7
## - `thinness 5-9 years` 1     24.3 4209.9 2567.9
## - `infant deaths`     1     30.8 4216.4 2570.4
## - `under-five deaths` 1     34.4 4220.0 2571.8
## - Schooling          1     37.0 4222.6 2572.8
## - Year              1    686.5 4872.1 2808.7
## - `HIV/AIDS`         1   1099.8 5285.4 2943.0
## - Country           132  26345.0 30530.7 4864.6
```

```
tranform_mod_3_back_bic = step(log_transform_3, direction = "backward", k = log(n))
```



```
## Start: AIC=2654.39
## `Life expectancy` ~ Country + Year + Status + `Adult Mortality` +
##   `infant deaths` + Alcohol + `percentage expenditure` + `Hepatitis B` +
##   Measles + BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(Population)
##
##
## Step: AIC=2654.39
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling + log(Population)
##
##
##           Df Sum of Sq      RSS      AIC
## - log(Population)          1         0.0  4147.6  2647.0
## - Polio                    1         0.1  4147.8  2647.0
## - Diphtheria               1         0.2  4147.9  2647.1
## - Population               1         0.3  4147.9  2647.1
## - `thinness 1-19 years`    1         0.3  4147.9  2647.1
## - BMI                     1         0.5  4148.1  2647.2
## - `percentage expenditure` 1         1.1  4148.7  2647.4
## - GDP                     1         1.6  4149.3  2647.6
## - `Total expenditure`     1         1.9  4149.5  2647.7
## - Measles                 1         2.8  4150.5  2648.1
## - `Adult Mortality`       1         3.9  4151.6  2648.5
## - `Hepatitis B`           1         4.8  4152.4  2648.9
## - `Income composition of resources` 1         7.6  4155.2  2650.0
## - `thinness 5-9 years`    1        12.5  4160.1  2651.9
## - Alcohol                 1        12.8  4160.4  2652.1
## <none>                     1        12.8  4160.4  2652.1
## - `infant deaths`         1        28.4  4176.0  2658.2
## - `under-five deaths`     1        32.0  4179.6  2659.7
## - Schooling               1        36.9  4184.5  2661.6
## - Year                   1       455.0  4602.6  2818.6
## - `HIV/AIDS`             1      1015.7  5163.3  3008.2
## - Country                132    16446.2 20593.8  4319.0
##
## Step: AIC=2646.98
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + Polio + `Total expenditure` +
##   Diphtheria + `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##
##           Df Sum of Sq      RSS      AIC
## - Polio                    1         0.1  4147.8  2639.6
## - Diphtheria               1         0.2  4147.9  2639.7
```

```

## - Population 1 0.3 4147.9 2639.7
## - `thinness 1-19 years` 1 0.3 4148.0 2639.7
## - BMI 1 0.5 4148.1 2639.8
## - `percentage expenditure` 1 1.1 4148.7 2640.0
## - GDP 1 1.6 4149.3 2640.2
## - `Total expenditure` 1 1.9 4149.6 2640.3
## - Measles 1 2.8 4150.5 2640.7
## - `Adult Mortality` 1 3.9 4151.6 2641.1
## - `Hepatitis B` 1 4.8 4152.4 2641.5
## - `Income composition of resources` 1 7.6 4155.2 2642.6
## - `thinness 5-9 years` 1 12.5 4160.1 2644.5
## - Alcohol 1 12.8 4160.4 2644.7
## <none> 4147.6 2647.0
## - `infant deaths` 1 28.4 4176.1 2650.8
## - `under-five deaths` 1 32.1 4179.7 2652.3
## - Schooling 1 37.0 4184.6 2654.2
## - Year 1 456.5 4604.1 2811.8
## - `HIV/AIDS` 1 1016.8 5164.4 3001.1
## - Country 132 16527.0 20674.7 4318.0
##
## Step: AIC=2639.63
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
## Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
## BMI + `under-five deaths` + `Total expenditure` + Diphtheria +
## `HIV/AIDS` + GDP + Population + `thinness 1-19 years` +
## `thinness 5-9 years` + `Income composition of resources` +
## Schooling
##
## Df Sum of Sq RSS AIC
## - Diphtheria 1 0.2 4147.9 2632.3
## - Population 1 0.3 4148.0 2632.3
## - `thinness 1-19 years` 1 0.3 4148.1 2632.3
## - BMI 1 0.5 4148.3 2632.4
## - `percentage expenditure` 1 1.1 4148.8 2632.6
## - GDP 1 1.6 4149.4 2632.9
## - `Total expenditure` 1 2.0 4149.7 2633.0
## - Measles 1 2.9 4150.6 2633.4
## - `Adult Mortality` 1 3.9 4151.7 2633.8
## - `Hepatitis B` 1 4.7 4152.4 2634.1
## - `Income composition of resources` 1 7.6 4155.4 2635.2
## - `thinness 5-9 years` 1 12.6 4160.3 2637.2
## - Alcohol 1 12.8 4160.5 2637.3
## <none> 4147.8 2639.6
## - `infant deaths` 1 28.6 4176.4 2643.6
## - `under-five deaths` 1 32.2 4180.0 2645.0
## - Schooling 1 36.9 4184.7 2646.8
## - Year 1 456.6 4604.4 2804.4
## - `HIV/AIDS` 1 1016.7 5164.4 2993.7
## - Country 132 16542.4 20690.1 4311.9
##
## Step: AIC=2632.29
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +

```

```
##      Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##      BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##      GDP + Population + `thinness 1-19 years` + `thinness 5-9 years` +
##      `Income composition of resources` + Schooling
##
##
##              Df Sum of Sq      RSS      AIC
## - Population          1          0.3  4148.2  2625.0
## - `thinness 1-19 years` 1          0.3  4148.2  2625.0
## - BMI                  1          0.5  4148.4  2625.1
## - `percentage expenditure` 1          1.1  4149.0  2625.3
## - GDP                  1          1.6  4149.5  2625.5
## - `Total expenditure` 1          2.0  4149.9  2625.7
## - Measles              1          2.8  4150.8  2626.0
## - `Adult Mortality`    1          3.9  4151.8  2626.4
## - `Hepatitis B`        1          7.1  4155.0  2627.7
## - `Income composition of resources` 1          7.9  4155.8  2628.0
## - `thinness 5-9 years` 1         12.6  4160.5  2629.9
## - Alcohol              1         12.8  4160.7  2629.9
## <none>                  4147.9  2632.3
## - `infant deaths`      1         28.9  4176.9  2636.3
## - `under-five deaths`  1         32.6  4180.5  2637.8
## - Schooling            1         37.1  4185.0  2639.6
## - Year                 1        456.9  4604.9  2797.2
## - `HIV/AIDS`          1       1020.4  5168.3  2987.6
## - Country              132     16656.3 20804.2  4313.5
##
## Step:  AIC=2624.99
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##      Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##      BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##      GDP + `thinness 1-19 years` + `thinness 5-9 years` + `Income composition of resources` +
##      Schooling
##
##
##              Df Sum of Sq      RSS      AIC
## - `thinness 1-19 years` 1          0.3  4148.5  2617.7
## - BMI                  1          0.5  4148.7  2617.8
## - `percentage expenditure` 1          1.1  4149.3  2618.0
## - GDP                  1          1.6  4149.8  2618.2
## - `Total expenditure` 1          1.9  4150.1  2618.4
## - Measles              1          3.0  4151.2  2618.8
## - `Adult Mortality`    1          4.0  4152.2  2619.2
## - `Hepatitis B`        1          7.0  4155.2  2620.4
## - `Income composition of resources` 1          7.9  4156.1  2620.7
## - Alcohol              1         12.9  4161.1  2622.7
## - `thinness 5-9 years` 1         12.9  4161.1  2622.7
## <none>                  4148.2  2625.0
## - `infant deaths`      1         29.6  4177.8  2629.3
## - `under-five deaths`  1         32.9  4181.1  2630.6
## - Schooling            1         36.9  4185.1  2632.2
## - Year                 1        456.7  4604.9  2789.8
## - `HIV/AIDS`          1       1021.7  5169.9  2980.7
```

```

## - Country                132    16656.9 20805.1 4306.2
##
## Step: AIC=2617.69
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   BMI + `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##               Df Sum of Sq    RSS    AIC
## - BMI          1      0.5  4149.0 2610.5
## - `percentage expenditure` 1      1.1  4149.5 2610.7
## - GDP          1      1.6  4150.1 2610.9
## - `Total expenditure`    1      1.9  4150.4 2611.1
## - Measles        1      2.9  4151.4 2611.5
## - `Adult Mortality`     1      4.0  4152.5 2611.9
## - `Hepatitis B`        1      7.1  4155.6 2613.1
## - `Income composition of resources` 1      7.9  4156.4 2613.4
## - Alcohol         1     12.8  4161.3 2615.4
## <none>                                4148.5 2617.7
## - `thinness 5-9 years`    1     22.2  4170.7 2619.1
## - `infant deaths`        1     29.4  4177.9 2621.9
## - `under-five deaths`    1     32.7  4181.2 2623.2
## - Schooling            1     36.8  4185.3 2624.9
## - Year                1    456.5  4605.0 2782.4
## - `HIV/AIDS`           1   1021.7  5170.1 2973.3
## - Country            132   16656.6 20805.1 4298.8
##
## Step: AIC=2610.49
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `percentage expenditure` + `Hepatitis B` + Measles +
##   `under-five deaths` + `Total expenditure` + `HIV/AIDS` +
##   GDP + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##               Df Sum of Sq    RSS    AIC
## - `percentage expenditure` 1      1.2  4150.2 2603.5
## - GDP          1      1.7  4150.7 2603.8
## - `Total expenditure`    1      1.8  4150.8 2603.8
## - Measles        1      3.0  4152.0 2604.3
## - `Adult Mortality`     1      4.0  4153.0 2604.7
## - `Hepatitis B`        1      6.9  4155.9 2605.8
## - `Income composition of resources` 1      7.7  4156.6 2606.1
## - Alcohol         1     12.8  4161.8 2608.2
## <none>                                4149.0 2610.5
## - `thinness 5-9 years`    1     22.4  4171.4 2611.9
## - `infant deaths`        1     29.4  4178.4 2614.7
## - `under-five deaths`    1     32.7  4181.7 2616.0
## - Schooling            1     36.8  4185.8 2617.7
## - Year                1    456.8  4605.8 2775.3
## - `HIV/AIDS`           1   1026.4  5175.4 2967.6
## - Country            132   16982.3 21131.3 4317.0

```

```
##
## Step: AIC=2603.55
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `Total expenditure` + `HIV/AIDS` + GDP + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##           Df Sum of Sq      RSS      AIC
## - GDP           1         0.9  4151.0  2596.5
## - `Total expenditure` 1         1.9  4152.1  2596.9
## - Measles        1         3.0  4153.2  2597.3
## - `Adult Mortality` 1         4.0  4154.1  2597.7
## - `Hepatitis B`    1         7.0  4157.2  2598.9
## - `Income composition of resources` 1         7.7  4157.8  2599.2
## - Alcohol         1        12.5  4162.7  2601.1
## <none>                                4150.2  2603.5
## - `thinness 5-9 years` 1        22.3  4172.5  2605.0
## - `infant deaths`    1        29.1  4179.2  2607.7
## - `under-five deaths` 1        32.4  4182.5  2609.0
## - Schooling          1        37.5  4187.6  2611.0
## - Year               1       459.9  4610.1  2769.5
## - `HIV/AIDS`        1      1025.3  5175.4  2960.2
## - Country           132     17019.7 21169.8  4312.6
##
## Step: AIC=2596.49
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `Total expenditure` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##           Df Sum of Sq      RSS      AIC
## - `Total expenditure` 1         1.8  4152.9  2589.8
## - Measles            1         3.0  4154.0  2590.3
## - `Adult Mortality`  1         3.9  4155.0  2590.6
## - `Hepatitis B`      1         6.9  4158.0  2591.8
## - `Income composition of resources` 1         7.5  4158.5  2592.0
## - Alcohol            1        12.3  4163.3  2594.0
## <none>                                4151.0  2596.5
## - `thinness 5-9 years` 1        22.3  4173.4  2597.9
## - `infant deaths`    1        29.0  4180.0  2600.6
## - `under-five deaths` 1        32.3  4183.3  2601.9
## - Schooling          1        37.0  4188.0  2603.7
## - Year               1       483.5  4634.5  2770.8
## - `HIV/AIDS`        1      1024.5  5175.5  2952.8
## - Country           132     17885.0 22036.0  4371.4
##
## Step: AIC=2589.8
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + Measles + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
```

```

##                                Df Sum of Sq      RSS      AIC
## - Measles                      1         2.9  4155.7  2583.5
## - `Adult Mortality`            1         3.9  4156.8  2584.0
## - `Hepatitis B`                1         6.7  4159.6  2585.1
## - `Income composition of resources` 1         7.6  4160.4  2585.4
## - Alcohol                      1        12.2  4165.0  2587.2
## <none>                          4152.9  2589.8
## - `thinness 5-9 years`         1        22.2  4175.1  2591.2
## - `infant deaths`             1        29.1  4181.9  2593.9
## - `under-five deaths`         1        32.4  4185.2  2595.2
## - Schooling                   1        37.2  4190.0  2597.1
## - Year                        1       481.7  4634.5  2763.3
## - `HIV/AIDS`                  1      1022.7  5175.5  2945.4
## - Country                     132     18014.7 22167.6  4373.8
##
## Step:  AIC=2583.53
## `Life expectancy` ~ Country + Year + `Adult Mortality` + `infant deaths` +
##   Alcohol + `Hepatitis B` + `under-five deaths` + `HIV/AIDS` +
##   `thinness 5-9 years` + `Income composition of resources` +
##   Schooling
##
##                                Df Sum of Sq      RSS      AIC
## - `Adult Mortality`            1         3.9  4159.6  2577.7
## - `Hepatitis B`                1         6.8  4162.5  2578.8
## - `Income composition of resources` 1         7.5  4163.2  2579.1
## - Alcohol                      1        12.2  4167.9  2581.0
## <none>                          4155.7  2583.5
## - `thinness 5-9 years`         1        22.8  4178.5  2585.1
## - `infant deaths`             1        27.4  4183.2  2587.0
## - `under-five deaths`         1        31.0  4186.7  2588.4
## - Schooling                   1        38.3  4194.0  2591.2
## - Year                        1       482.8  4638.5  2757.4
## - `HIV/AIDS`                  1      1021.8  5177.5  2938.6
## - Country                     132     18052.6 22208.3  4369.4
##
## Step:  AIC=2577.67
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `Hepatitis B` + `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##                                Df Sum of Sq      RSS      AIC
## - `Hepatitis B`                1         6.6  4166.2  2572.9
## - `Income composition of resources` 1         7.7  4167.3  2573.3
## - Alcohol                      1        12.3  4171.9  2575.1
## <none>                          4159.6  2577.7
## - `thinness 5-9 years`         1        22.9  4182.5  2579.3
## - `infant deaths`             1        27.4  4187.0  2581.1
## - `under-five deaths`         1        30.8  4190.4  2582.4
## - Schooling                   1        38.6  4198.2  2585.5
## - Year                        1       489.2  4648.8  2753.6
## - `HIV/AIDS`                  1      1071.3  5230.9  2948.2
## - Country                     132     22622.6 26782.2  4670.8

```

```
##
## Step: AIC=2572.86
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   `Income composition of resources` + Schooling
##
##               Df Sum of Sq      RSS      AIC
## - `Income composition of resources` 1      7.9 4174.1 2568.6
## - Alcohol                          1     12.1 4178.3 2570.2
## <none>                              4166.2 2572.9
## - `thinness 5-9 years`              1     23.8 4190.0 2574.9
## - `infant deaths`                  1     27.3 4193.5 2576.2
## - `under-five deaths`              1     31.2 4197.4 2577.8
## - Schooling                        1     38.7 4204.8 2580.7
## - Year                             1    515.0 4681.2 2757.7
## - `HIV/AIDS`                       1   1076.3 5242.5 2944.4
## - Country                         132  22626.1 26792.3 4664.0
##
## Step: AIC=2568.59
## `Life expectancy` ~ Country + Year + `infant deaths` + Alcohol +
##   `under-five deaths` + `HIV/AIDS` + `thinness 5-9 years` +
##   Schooling
##
##               Df Sum of Sq      RSS      AIC
## - Alcohol                          1     11.5 4185.6 2565.7
## <none>                              4174.1 2568.6
## - `thinness 5-9 years`              1     24.1 4198.2 2570.7
## - `infant deaths`                  1     27.3 4201.4 2571.9
## - `under-five deaths`              1     31.1 4205.2 2573.4
## - Schooling                        1     38.5 4212.6 2576.3
## - Year                             1    646.6 4820.7 2798.7
## - `HIV/AIDS`                       1   1070.3 5244.4 2937.6
## - Country                         132  26354.1 30528.2 4871.8
##
## Step: AIC=2565.72
## `Life expectancy` ~ Country + Year + `infant deaths` + `under-five deaths` +
##   `HIV/AIDS` + `thinness 5-9 years` + Schooling
##
##               Df Sum of Sq      RSS      AIC
## <none>                              4185.6 2565.7
## - `thinness 5-9 years`              1     24.3 4209.9 2567.9
## - `infant deaths`                  1     30.8 4216.4 2570.4
## - `under-five deaths`              1     34.4 4220.0 2571.8
## - Schooling                        1     37.0 4222.6 2572.8
## - Year                             1    686.5 4872.1 2808.7
## - `HIV/AIDS`                       1   1099.8 5285.4 2943.0
## - Country                         132  26345.0 30530.7 4864.6
```

```
metrics_tranform_mod_1_back_aic = calc_model_metrics(tranform_mod_1_back_aic)
metrics_tranform_mod_2_back_aic = calc_model_metrics(tranform_mod_2_back_aic)
metrics_tranform_mod_3_back_aic = calc_model_metrics(tranform_mod_3_back_aic)
```

```
metrics_tranform_mod_1_back_bic = calc_model_metrics(tranform_mod_1_back_bic)
metrics_tranform_mod_2_back_bic = calc_model_metrics(tranform_mod_2_back_bic)
metrics_tranform_mod_3_back_bic = calc_model_metrics(tranform_mod_3_back_bic)
```

```
additive_model_summary = data.frame(
  Variables_Log_Transformed = c("additive AIC", "Additive BIC"),

  Adjusted_R_Squared =
    c(metrics_additive_mod_back_aic$Adj_R_Squared, metrics_additive_mod_back_bic$Adj_R_Squared),

  RMSE = c(metrics_additive_mod_back_aic$RMSE, metrics_additive_mod_back_bic$RMSE),

  LOOCV_RMSE =
    c(metrics_additive_mod_back_aic$LOOCV_RMSE, metrics_additive_mod_back_bic$LOOCV_RMSE),

  AIC = c(metrics_additive_mod_back_aic$AIC, metrics_additive_mod_back_bic$AIC)

)

knitr::kable(additive_model_summary, caption = "Additive model AIC and BIC Summary", digits = 4)
```

Additive model AIC and BIC Summary

Variables_Log_Transformed	Adjusted_R_Squared	RMSE	LOOCV_RMSE	AIC
additive AIC	0.9643	1.5882	1.7430	1809.740
Additive BIC	0.9642	1.5932	1.7455	1814.022


```

corr_model_summary = data.frame(
  Variables_Log_Transformed = c("corr AIC model 1", "corr AIC model 2", "corr AIC model
3",
                                "corr BIC model 1", "corr BIC model 2", "corr BIC model 3"
),

  Adjusted_R_Squared =
c(metrics_corr_mod_1_back_aic$Adj_R_Squared, metrics_corr_mod_2_back_aic$Adj_R_Square
d,
  metrics_corr_mod_3_back_aic$Adj_R_Squared,
  metrics_corr_mod_1_back_bic$Adj_R_Squared, metrics_corr_mod_2_back_bic$Adj_R_Square
d,
  metrics_corr_mod_3_back_bic$Adj_R_Squared
),

  RMSE =
  c(metrics_corr_mod_1_back_aic$RMSE, metrics_corr_mod_2_back_aic$RMSE,
  metrics_corr_mod_3_back_aic$RMSE,
  metrics_corr_mod_1_back_bic$RMSE, metrics_corr_mod_2_back_bic$RMSE,
  metrics_corr_mod_3_back_bic$RMSE
),
  LOOCV_RMSE =
  c(metrics_corr_mod_1_back_aic$LOOCV_RMSE, metrics_corr_mod_2_back_aic$LOOCV_RMSE,
  metrics_corr_mod_3_back_aic$LOOCV_RMSE,
  metrics_corr_mod_1_back_bic$LOOCV_RMSE, metrics_corr_mod_2_back_bic$LOOCV_RMSE,
  metrics_corr_mod_3_back_bic$LOOCV_RMSE
),

  AIC = c(metrics_corr_mod_1_back_aic$AIC, metrics_corr_mod_2_back_aic$AIC,
  metrics_corr_mod_3_back_aic$AIC,
  metrics_corr_mod_1_back_bic$AIC, metrics_corr_mod_2_back_bic$AIC,
  metrics_corr_mod_3_back_bic$AIC
)
)

knitr::kable(corr_model_summary, caption = "correlation transformed model AIC and BIC Su
mmmary", digits = 4)

```

correlation transformed model AIC and BIC Summary

Variables_Log_Transformed	Adjusted_R_Squared	RMSE	LOOCV_RMSE	AIC
corr AIC model 1	0.9641	1.5935	1.7457	1818.552
corr AIC model 2	0.9640	1.5958	1.7484	1823.343
corr AIC model 3	0.9643	1.5882	1.7430	1809.740
corr BIC model 1	0.9639	1.6003	1.7497	1824.704
corr BIC model 2	0.9638	1.6043	1.7531	1830.836
corr BIC model 3	0.9642	1.5932	1.7455	1814.022

```

transform_model_summary = data.frame(
  Variables_Log_Transformed = c("Log transform AIC model 1", "Log transform AIC model
2", "Log transform AIC model 3",
                                "Log transform BIC model 1", "Log transformBIC model 2",
"Log transform BIC model 3" ),

  Adjusted_R_Squared =
    c(metrics_tranform_mod_1_back_aic$Adj_R_Squared, metrics_tranform_mod_2_back_aic$Adj_R
_Squared, metrics_tranform_mod_3_back_aic$Adj_R_Squared,

      metrics_tranform_mod_1_back_bic$Adj_R_Squared, metrics_tranform_mod_2_back_bic$Adj_R
_Squared, metrics_tranform_mod_3_back_bic$Adj_R_Squared
    ),

  RMSE =
    c(metrics_tranform_mod_1_back_aic$RMSE, metrics_tranform_mod_2_back_aic$RMSE,
      metrics_tranform_mod_3_back_aic$RMSE,
      metrics_tranform_mod_1_back_bic$RMSE, metrics_tranform_mod_2_back_bic$RMSE,
      metrics_tranform_mod_3_back_bic$RMSE
    ),

  LOOCV_RMSE =
    c(metrics_tranform_mod_1_back_aic$LOOCV_RMSE, metrics_tranform_mod_2_back_aic$LOOCV_
RMSE,
      metrics_tranform_mod_3_back_aic$LOOCV_RMSE,
      metrics_tranform_mod_1_back_bic$LOOCV_RMSE, metrics_tranform_mod_2_back_bic$LOOCV_RM
SE,
      metrics_tranform_mod_3_back_bic$LOOCV_RMSE
    ),

  AIC = c(metrics_tranform_mod_1_back_aic$AIC, metrics_tranform_mod_2_back_aic$AIC,
      metrics_tranform_mod_3_back_aic$AIC,
      metrics_tranform_mod_1_back_bic$AIC, metrics_tranform_mod_2_back_bic$AIC,
      metrics_tranform_mod_3_back_bic$AIC
    )
)

knitr::kable(transform_model_summary, caption = "log transformation model AIC and BIC Su
mmmary", digits = 4)

```

log transformation model AIC and BIC Summary

Variables_Log_Transformed	Adjusted_R_Squared	RMSE	LOOCV_RMSE	AIC
Log transform AIC model 1	0.9643	1.5882	1.7430	1809.740
Log transform AIC model 2	0.9643	1.5882	1.7430	1809.740
Log transform AIC model 3	0.9643	1.5882	1.7430	1809.740
Log transform BIC model 1	0.9642	1.5932	1.7455	1814.022
Log transformBIC model 2	0.9642	1.5932	1.7455	1814.022

Variables_Log_Transformed	Adjusted_R_Squared	RMSE	LOOCV_RMSE	AIC
Log transform BIC model 3	0.9642	1.5932	1.7455	1814.022

Results

Discussions

Appendix

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