Modeling GDP Using Health and Socioeconomic Indicators

Erin Xu, Dora Dong, Shencen Cai, Sharon Lam

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Introduction

Gross domestic product (GDP) is a widely used measure of a country's economic output, representing the total market value of goods and services produced within its borders over a specified period. It serves as a key indicator of national economic performance and enables comparison across countries and time periods. From economic theory, GDP is influenced by components such as consumer spending, government expenditures, investment in capital goods, and net exports. Factors like human capital, infrastructure, technological innovation, and political stability are also vital.

This project applies multiple linear regression (MLR) to investigate the extent to which health-related and socioeconomic factors are associated with GDP, with the research question being: *To what extent do government spending on health and socioeconomic resources affect a country's GDP?* Specifically, country status (developed vs. developing), percentage expenditure on health, polio immunization coverage, income composition of resources, years of schooling, and population are the combination of continuous and categorical predictors used to explain the extent in which they affect GDP in countries around the world. Health spending, represented by percent of a country's expenditure and polio immunization coverage, has been shown to enhance productivity, and income composition and national development status reflect broader socioeconomic conditions. Education and population are also recognized as structural drivers of economic growth because educated workers increases human capital, research and innovation for better products, processes and overall economic advancement.

As economic theory suggests a positive relationship between GDP and improved development indicators, and estimating a linear model allows us to quantify the individual contribution of each predictor to GDP while controlling for the others, a positive relationship between GDP and indicated predictors can be expected. The focus of this analysis is on interpretability, to understand how each predictor relates to economic output and to support evidence-based approaches to development and policy planning.

Data description

The dataset used in this project is titled *Life Expectancy* (WHO), sourced from *Kaggle* (Kumar, 2018). Its primary usage is for health data analysis. Data collectors combined publicly available data from the *World Health Organization* (WHO) and the *United Nations* (UN), which were gathered through national health departments, structured questionnaires, and annual statistical submissions by participating countries (World Health Organization, n.d.; United Nations, n.d.). The sample comprises over 1,600 complete observations, focusing on education, demographic, and socioeconomic indicators relevant to economic growth.

While the dataset was initially intended to examine factors affecting life expectancy, this project selects 7 of the original 22 variables that align with economic theory, which emphasizes the importance of education, health, and human capital in supporting sustained increases in GDP.

The preliminary model is prone to multiple violations of model assumption, but multiple linear regression is still an appropriate method for analysis, as the scatterplots of the response and each predictor show a

huge potential for linear association, constant error variance, and uncorrelated and normal errors, through diagnostic procedures like predictor transformations.

Table 1: Variables used in the model

Variable	**Description**	**Type**
GDP	Gross Domestic Product per capita (USD)	Response variable
Status	Developed or Developing status	Categorical variable
Percentage expenditure	Expenditure on health as a percentage of Gross Domestic Product per capita (%)	Continuous variable
Polio	Polio immunization coverage among 1-year-olds (%)	Continuous variable
Population	Population of the country	Continuous variable
Income composition of resources	Human Development Index in terms of income composition (index from 0 to 1)	Continuous variable
Schooling	Number of years of schooling (years)	Continuous variable

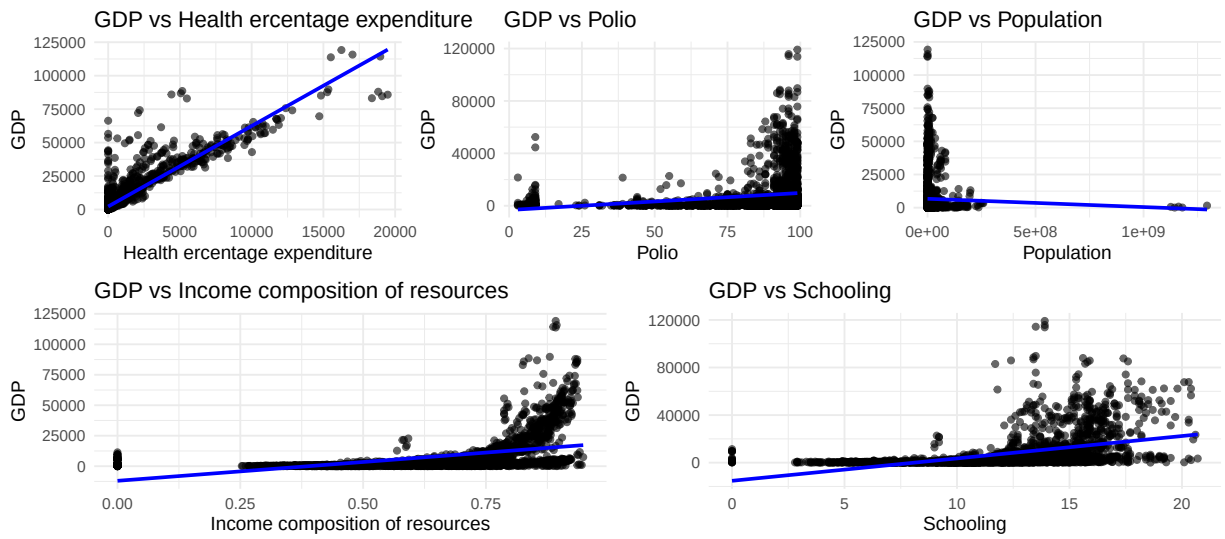
Table 2: Continuous variables summary

Variable	Mean	Std	Min	Q1	Median	Q3	Max
GDP	7483.16	14270.17	1.68	463.94	1766.95	5910.81	119172.74
Percentage expenditure	738.25	1987.91	0.01	4.69	64.91	441.53	19479.91
Polio	82.55	23.43	3.00	78.00	93.00	97.00	99.00
Population	1.28e+07	6.10e+07	34.00	1.96e+05	1.39e+06	7.42e+06	1.29e+09
Income composition of resources	0.63	0.21	0.00	0.49	0.68	0.78	0.95
Schooling	11.99	3.36	0.00	10.10	12.30	14.30	20.70

Table 3: Status (categorical variable) frequency

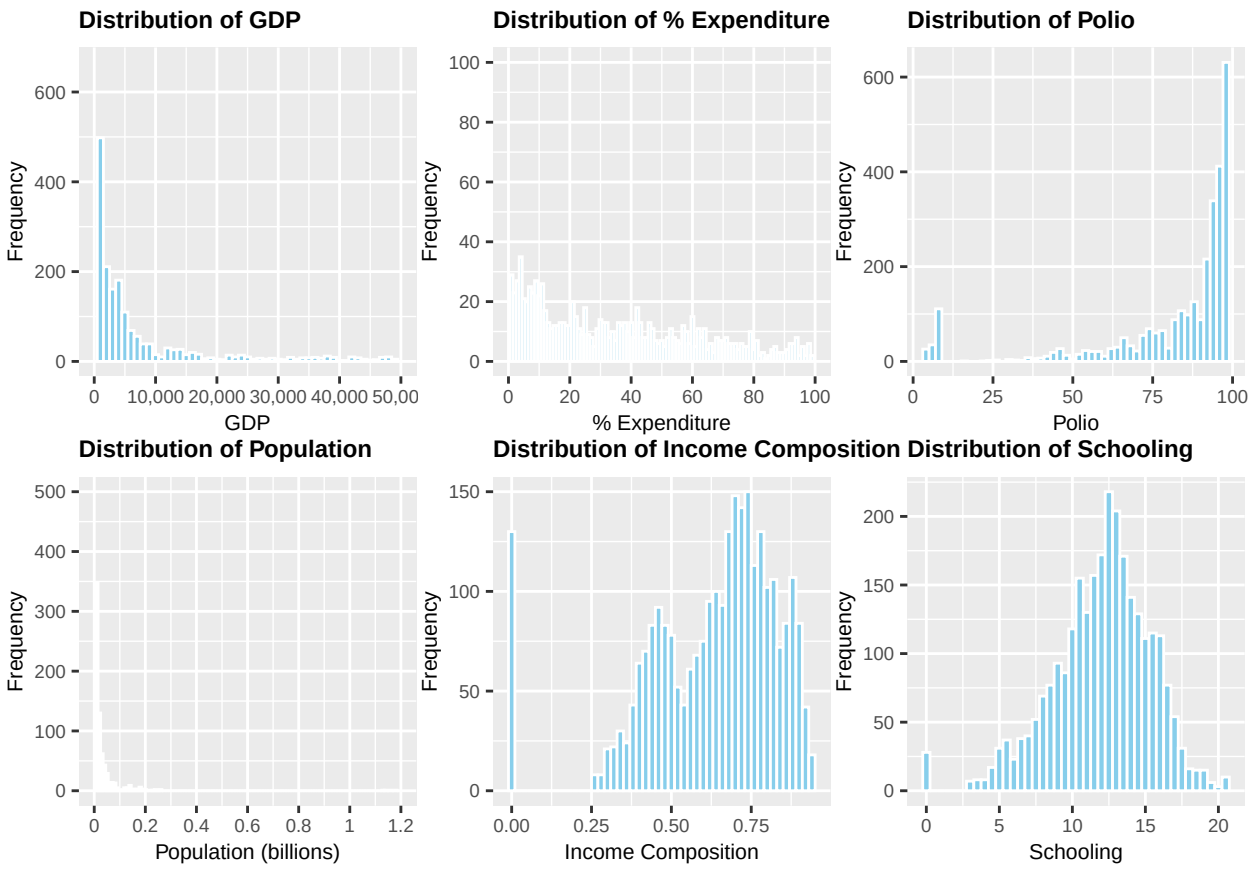
Status	Frequency
Developing	2426
Developed	512
Total	2938

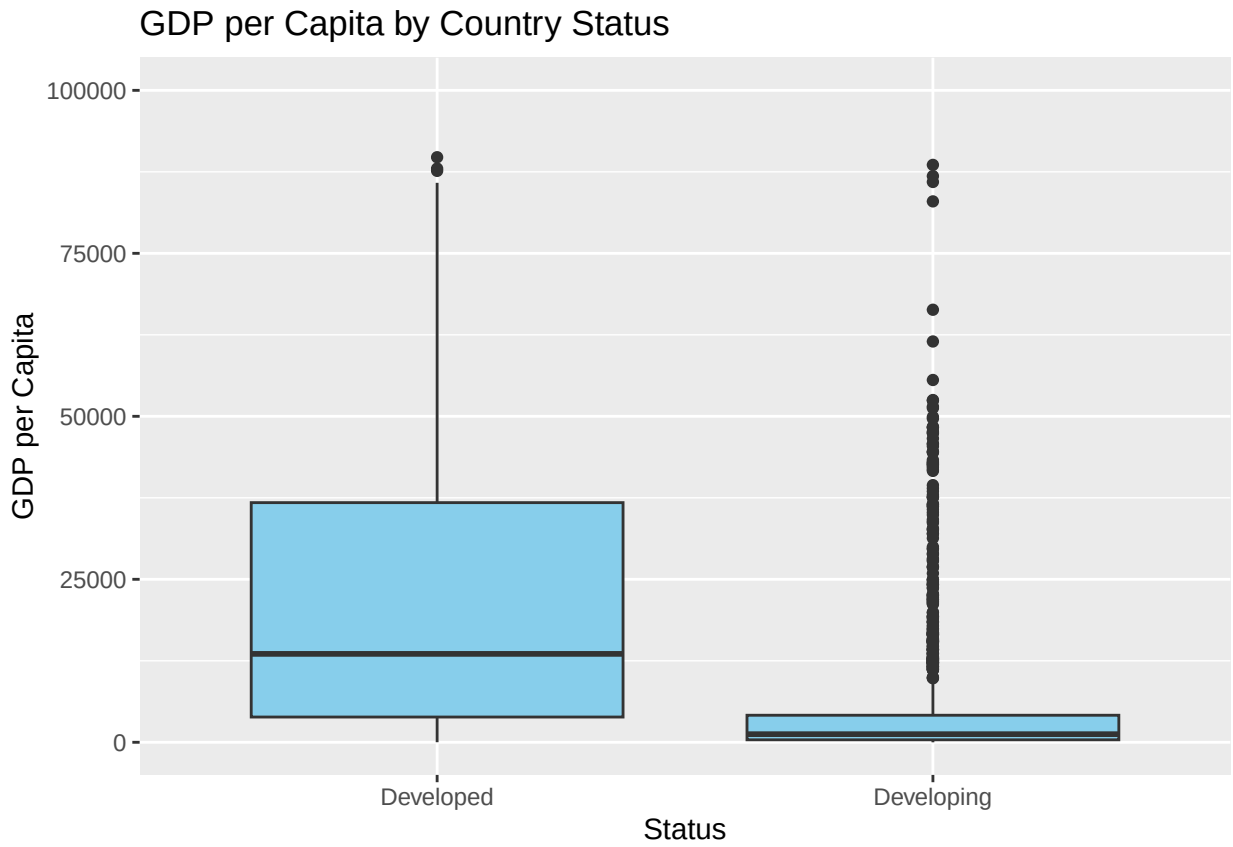
Figure 1: Scatter plots of GDP against numeric predictors



GDP increases as health percentage expenditure does in a rather compelling linear manner, although the clustering near the lower ends of the domain is concerning due to outliers in countries that are experiencing geopolitical turmoil. GDP and polio as well as income composition of resources and schooling demonstrate weaker positive trends, looking more quadratic, most likely with leverage points at the tails. It's clear that there are bad leverage points in GDP and population. In the context of geography and the complexity of individual states, one can suspend their disbelief easily about certain leverage points, but nonetheless, these need to be dealt with to provide a more accurate prediction of GDP with the set predictors at hand.

Figure 2: Histogram of GDP & numeric predictors


Distribution of GDP
Frequency
GDP
Distribution of % Expenditure
% Expenditure
Distribution of Polio
Polio
Distribution of Population
Population (billions)
Distribution of Income Composition
Income Composition
Distribution of Schooling
Schooling



GDP, percentage expenditure, and population are strongly right-skewed, with mostly low values. Schooling and income composition are slightly left-skewed, clustering at the high end. Income composition is also bimodal, although there is potential for a bell-curve-like shape. Polio rates are highly left-skewed. Since country status is a categorical predictor, the boxplot graph is better suited to evaluating the normality assumption. Developed countries have a higher median GDP per capital and wider IQR range, which indicates greater variability than developing countries, which violates a model assumption. Also, developing countries appear highly skewed to the right, with most countries clustered at low GDP per capital values. The long tail of outliers stretching upward indicate a few developing countries with relatively high GDPs. In context, these outlier countries like Malaysia, Mexico, or Turkey are often classified more deeply as upper-middle-income economies (World Bank) because they clearly act as outliers compared to the rest of the developing world.

Primary model results and diagnostics

Initially, the distribution of GDP was heavily right-skewed due to a small number of countries with disproportionately large economies. Residual plots also showed signs of heteroscedasticity, violating regression assumptions. To address this, we applied a log transformation to the response variable, which preserved the interpretability of a linear model while improving the spread of residuals.

The adjusted R-squared of the transformed model was 0.9258, indicating that 92.6% of the variation in GDP is explained by the model. Among numerical predictors, percentage expenditure on health and schooling were both statistically significant ($p < 0.001$), suggesting strong positive relationships with GDP. This supports the idea that education and health investment enhance human capital and economic productivity (Radcliffe, Raghupathi). For the categorical predictor Status (Developed vs. Developing), the p-value was approximately 0.0038, indicating that developed countries tend to have significantly higher GDPs after accounting for other

variables. In contrast, polio immunization and population size were not statistically significant, implying weaker associations.

The residual plots assess linearity and constant variance assumptions. Residuals were mostly centered around zero, but a slight V-shape indicates some remaining heteroscedasticity, especially at the lower and higher ends of fitted GDP. This suggests more stable residuals in middle-income countries, while richer and poorer countries show more unpredictable patterns. For example, the U.S., Qatar, and Luxembourg all have high GDPs, but for very different reasons (tech, gas, or tax policy). Similarly, lower-income countries may have inconsistent or less reliable data.

The Q-Q plot showed that residuals were somewhat normal, but skewed left. Residuals versus individual predictors showed random scatter for income composition and schooling, but some structure for expenditure, population, and polio, suggesting potential nonlinearities.

Overall, the model shows evidence that educational and economic factors influence GDP, though remaining issues with heteroscedasticity and non-normal residuals should be better resolved, as these violations weaken ordinary least squares (OLS) model accuracy. Employing further transformations like Box-Cox, investigating covariance, colinearity, the removal of bad leverage points and outliers, comparison of different models through F-test and analysis of variance (ANOVA), or even exploring weighted least squares (WLS) are key stratagem to confidently predict the expected GDP in a country.

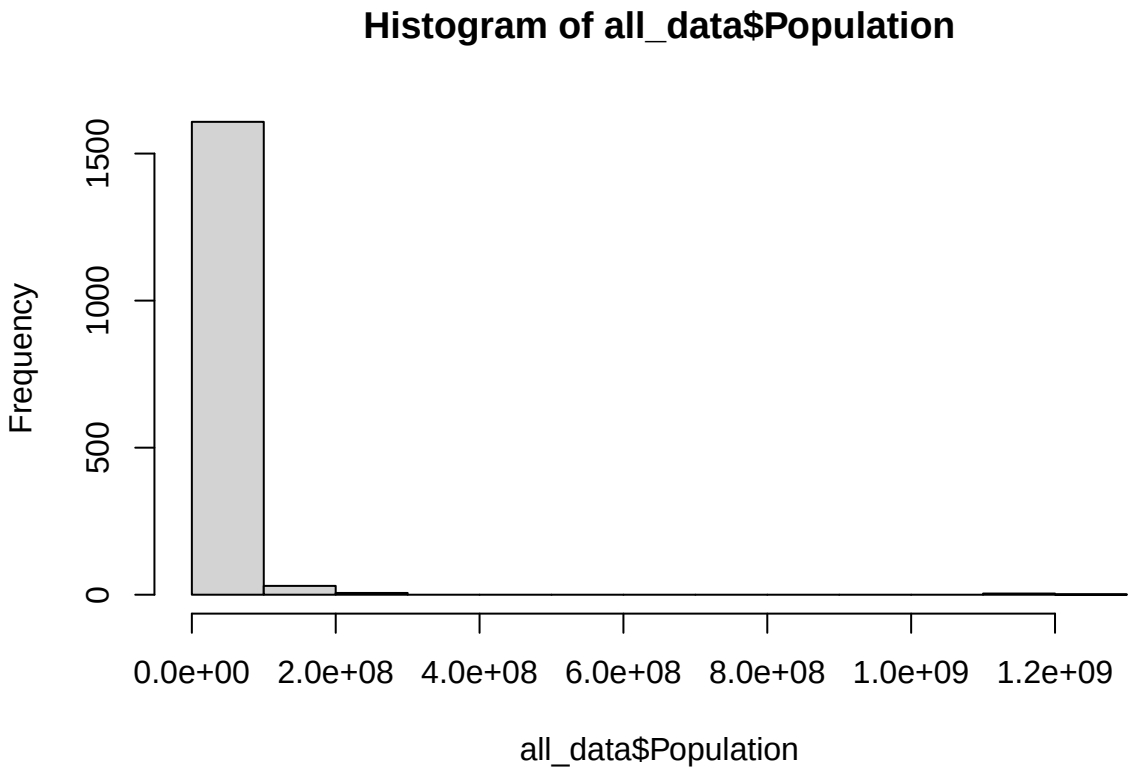
Model seleection

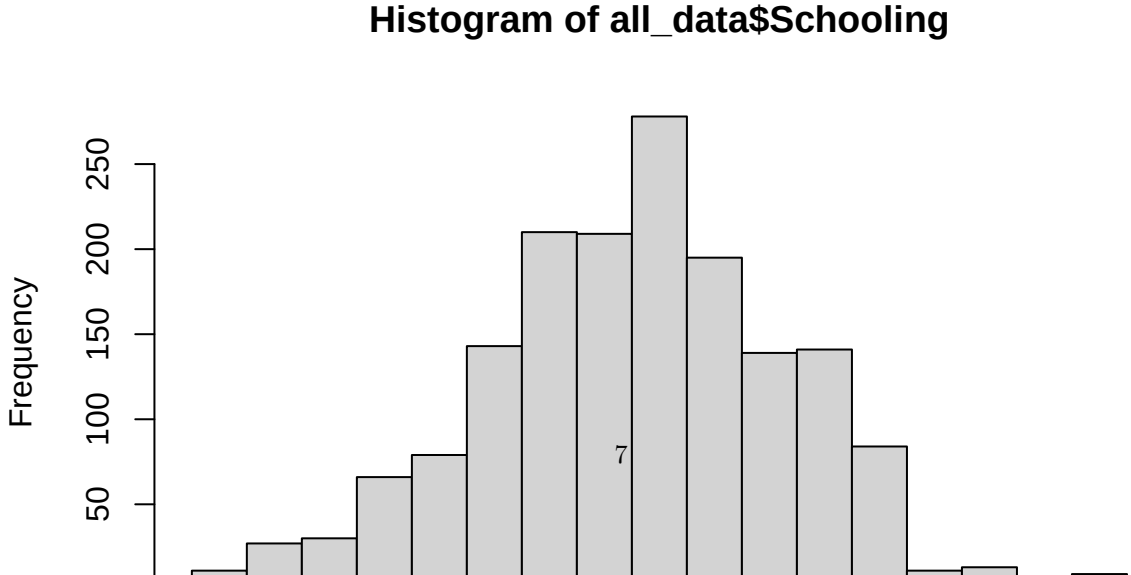
Final model inference and results

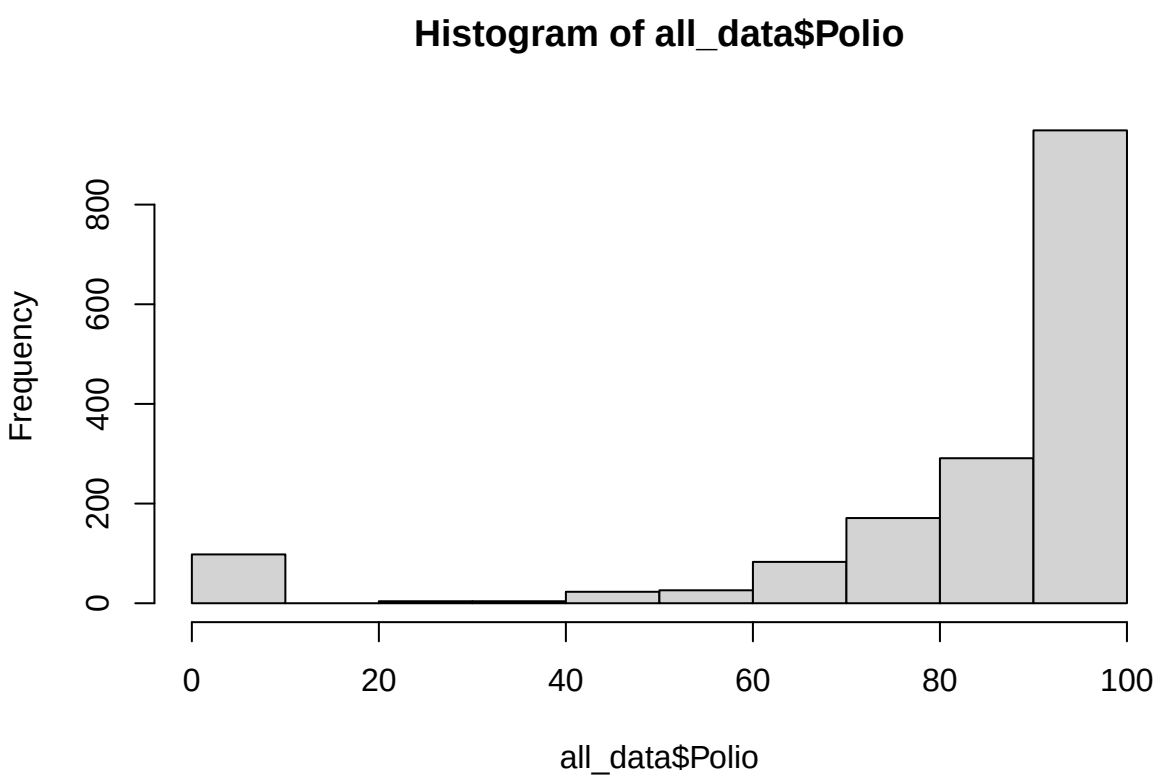
Discussion and conclusion ‘

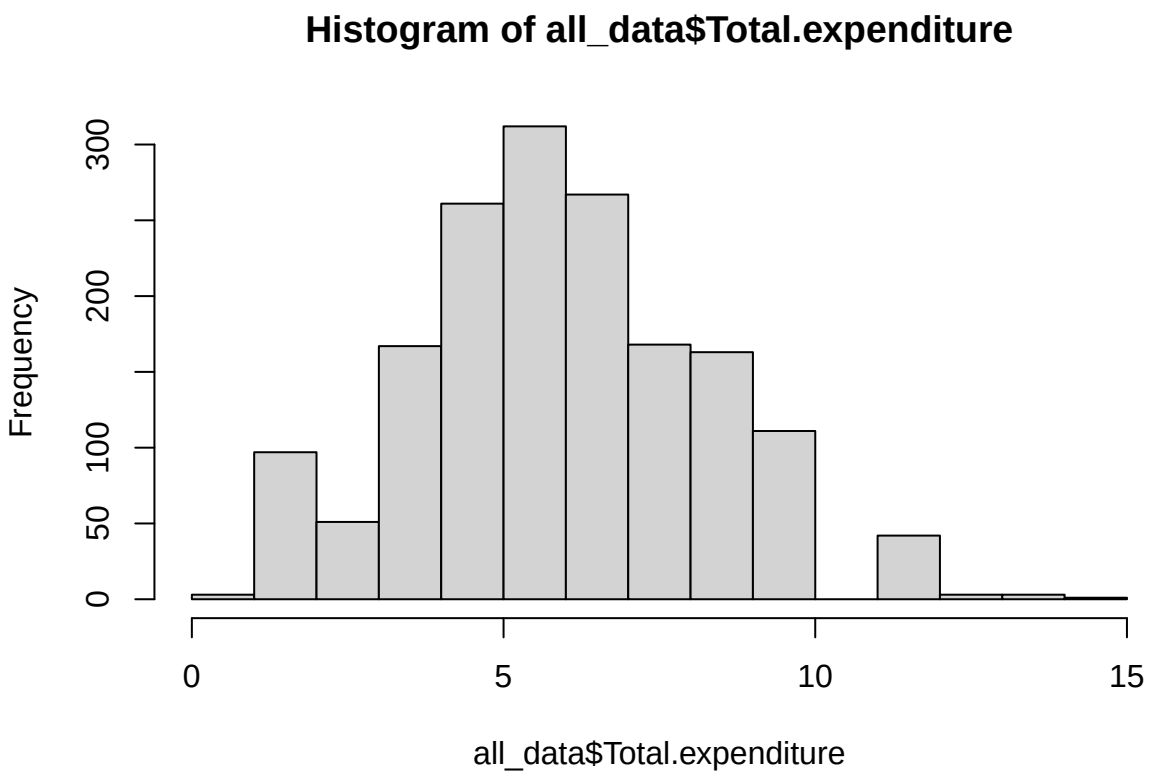
Author contributions

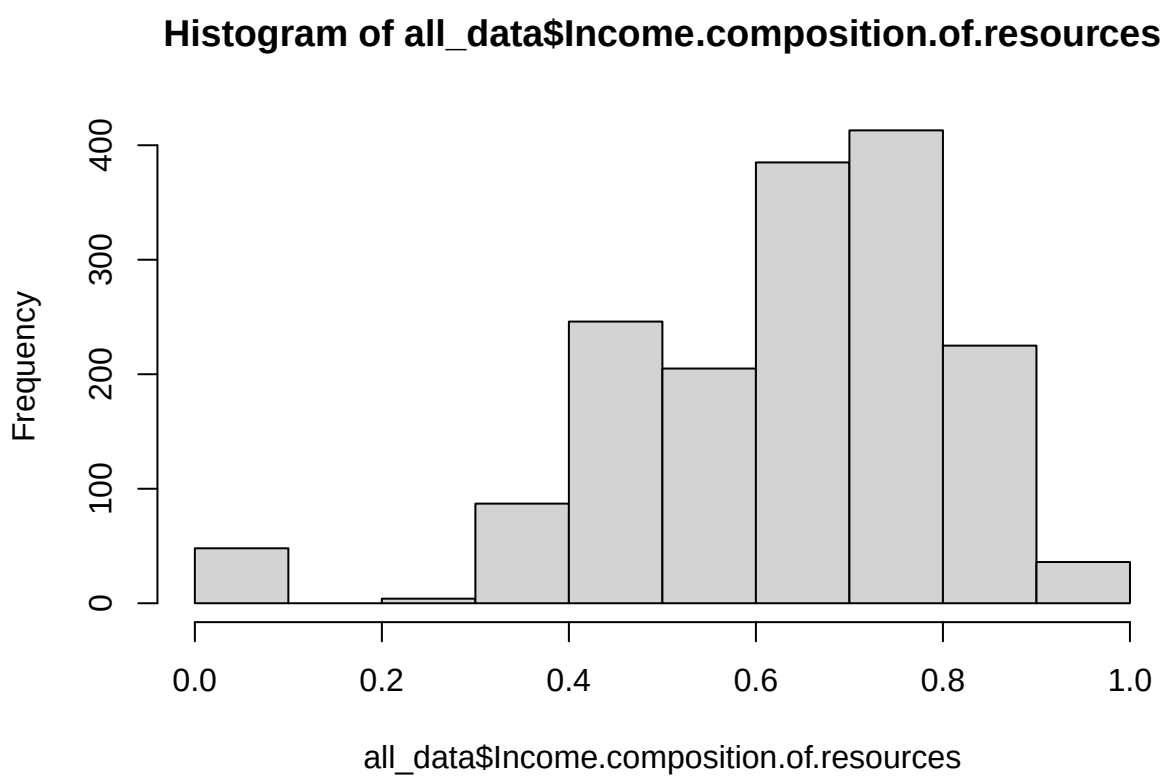
References






Histogram of all_data$Polio
Frequency
0
200
400
600
800
0
20
40
60
80
100
all_data$Polio


Histogram of all_data$Total.expenditure
Frequency
0
50
100
200
300
0
5
10
15
all_data$Total.expenditure




```
##
## Call:
## lm(formula = GDP ~ Life.expectancy + Status + Adult.Mortality +
##     infant.deaths + Alcohol + Total.expenditure + percentage.expenditure +
##     Hepatitis.B + Measles + BMI + under.five.deaths + Polio +
##     Diphtheria + HIV.AIDS + Population + thinness..1.19.years +
##     thinness.5.9.years + Income.composition.of.resources + Schooling,
##     data = all_data)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -11955  -1094   -374    420  39494
##
## Coefficients:
##                                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)                    -1.862e+03  1.387e+03  -1.342  0.17974
## Life.expectancy                 6.664e+00  2.164e+01   0.308  0.75813
## StatusDeveloping               -7.400e+02  2.953e+02  -2.506  0.01231 *
## Adult.Mortality                 4.601e-01  9.038e-01   0.509  0.61076
## infant.deaths                   5.775e-01  9.521e+00   0.061  0.95164
## Alcohol                         6.869e+00  2.903e+01   0.237  0.81297
## Total.expenditure              -5.451e+01  3.553e+01  -1.534  0.12521
## percentage.expenditure          5.989e+00  5.276e-02 113.516  < 2e-16 ***
## Hepatitis.B                     3.972e+00  3.886e+00   1.022  0.30686
## Measles                        -6.929e-04  9.421e-03  -0.074  0.94138
## BMI                            -4.532e+00  5.288e+00  -0.857  0.39148
```

```
## under.five.deaths                1.908e-01  6.904e+00   0.028  0.97796
## Polio                            5.025e+00  4.501e+00   1.116  0.26438
## Diphtheria                      -3.010e+00  5.186e+00  -0.580  0.56172
## HIV.AIDS                         1.325e+00  1.823e+01   0.073  0.94207
## Population                      -9.416e-07  1.527e-06  -0.617  0.53755
## thinness..1.19.years             1.399e+01  4.629e+01   0.302  0.76252
## thinness.5.9.years              -3.130e+01  4.569e+01  -0.685  0.49342
## Income.composition.of.resources  2.043e+03  7.554e+02   2.705  0.00691 **
## Schooling                        1.732e+02  5.499e+01   3.150  0.00166 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3133 on 1629 degrees of freedom
## Multiple R-squared:  0.9263, Adjusted R-squared:  0.9255
## F-statistic:  1078 on 19 and 1629 DF,  p-value: < 2.2e-16

## Start:  AIC=26568.24
## GDP ~ Life.expectancy + Status + Adult.Mortality + infant.deaths +
##     Alcohol + Total.expenditure + percentage.expenditure + Hepatitis.B +
##     Measles + BMI + under.five.deaths + Polio + Diphtheria +
##     HIV.AIDS + Population + thinness..1.19.years + thinness.5.9.years +
##     Income.composition.of.resources + Schooling
##
##                                  Df  Sum of Sq        RSS   AIC
## - under.five.deaths               1 7.4980e+03 1.5993e+10 26566
## - infant.deaths                   1 3.6125e+04 1.5993e+10 26566
## - HIV.AIDS                        1 5.1865e+04 1.5993e+10 26566
## - Measles                         1 5.3109e+04 1.5993e+10 26566
## - Alcohol                         1 5.4974e+05 1.5993e+10 26566
## - thinness..1.19.years            1 8.9674e+05 1.5994e+10 26566
## - Life.expectancy                 1 9.3129e+05 1.5994e+10 26566
## - Adult.Mortality                 1 2.5444e+06 1.5995e+10 26566
## - Diphtheria                      1 3.3072e+06 1.5996e+10 26567
## - Population                      1 3.7332e+06 1.5996e+10 26567
## - thinness.5.9.years              1 4.6071e+06 1.5997e+10 26567
## - BMI                             1 7.2132e+06 1.6000e+10 26567
## - Hepatitis.B                     1 1.0257e+07 1.6003e+10 26567
## - Polio                           1 1.2238e+07 1.6005e+10 26568
## <none>                                         1.5993e+10 26568
## - Total.expenditure               1 2.3103e+07 1.6016e+10 26569
## - Status                          1 6.1654e+07 1.6054e+10 26573
## - Income.composition.of.resources 1 7.1822e+07 1.6064e+10 26574
## - Schooling                       1 9.7429e+07 1.6090e+10 26576
## - percentage.expenditure          1 1.2651e+11 1.4250e+11 30173
##
## Step:  AIC=26566.24
## GDP ~ Life.expectancy + Status + Adult.Mortality + infant.deaths +
##     Alcohol + Total.expenditure + percentage.expenditure + Hepatitis.B +
##     Measles + BMI + Polio + Diphtheria + HIV.AIDS + Population +
##     thinness..1.19.years + thinness.5.9.years + Income.composition.of.resources +
##     Schooling
##
##                                  Df  Sum of Sq        RSS   AIC
## - HIV.AIDS                        1 4.8272e+04 1.5993e+10 26564
```

```
## - Measles                           1 6.5722e+04 1.5993e+10 26564
## - Alcohol                           1 5.8425e+05 1.5993e+10 26564
## - thinness..1.19.years              1 9.0256e+05 1.5994e+10 26564
## - Life.expectancy                   1 9.4052e+05 1.5994e+10 26564
## - Adult.Mortality                   1 2.5494e+06 1.5995e+10 26564
## - Diphtheria                        1 3.3610e+06 1.5996e+10 26565
## - Population                        1 3.9124e+06 1.5997e+10 26565
## - thinness.5.9.years                1 4.6559e+06 1.5997e+10 26565
## - infant.deaths                     1 5.9284e+06 1.5999e+10 26565
## - BMI                               1 7.2168e+06 1.6000e+10 26565
## - Hepatitis.B                       1 1.0258e+07 1.6003e+10 26565
## - Polio                             1 1.2235e+07 1.6005e+10 26566
## <none>                                           1.5993e+10 26566
## - Total.expenditure                 1 2.3098e+07 1.6016e+10 26567
## + under.five.deaths                 1 7.4980e+03 1.5993e+10 26568
## - Status                            1 6.1675e+07 1.6054e+10 26571
## - Income.composition.of.resources   1 7.1819e+07 1.6064e+10 26572
## - Schooling                         1 9.7535e+07 1.6090e+10 26574
## - percentage.expenditure            1 1.2686e+11 1.4285e+11 30175
##
## Step:  AIC=26564.24
## GDP ~ Life.expectancy + Status + Adult.Mortality + infant.deaths +
##     Alcohol + Total.expenditure + percentage.expenditure + Hepatitis.B +
##     Measles + BMI + Polio + Diphtheria + Population + thinness..1.19.years +
##     thinness.5.9.years + Income.composition.of.resources + Schooling
##
##                                   Df  Sum of Sq        RSS   AIC
## - Measles                          1 6.1993e+04 1.5993e+10 26562
## - Alcohol                          1 5.9383e+05 1.5993e+10 26562
## - thinness..1.19.years             1 9.0462e+05 1.5994e+10 26562
## - Life.expectancy                  1 9.9482e+05 1.5994e+10 26562
## - Adult.Mortality                  1 2.7397e+06 1.5995e+10 26562
## - Diphtheria                       1 3.3350e+06 1.5996e+10 26563
## - Population                       1 3.9084e+06 1.5997e+10 26563
## - thinness.5.9.years               1 4.6404e+06 1.5997e+10 26563
## - infant.deaths                    1 5.8850e+06 1.5999e+10 26563
## - BMI                              1 7.1721e+06 1.6000e+10 26563
## - Hepatitis.B                      1 1.0210e+07 1.6003e+10 26563
## - Polio                            1 1.2302e+07 1.6005e+10 26564
## <none>                                          1.5993e+10 26564
## - Total.expenditure                1 2.3153e+07 1.6016e+10 26565
## + HIV.AIDS                         1 4.8272e+04 1.5993e+10 26566
## + under.five.deaths                1 3.9040e+03 1.5993e+10 26566
## - Status                           1 6.1733e+07 1.6054e+10 26569
## - Income.composition.of.resources  1 7.3204e+07 1.6066e+10 26570
## - Schooling                        1 1.0188e+08 1.6095e+10 26573
## - percentage.expenditure           1 1.2809e+11 1.4409e+11 30187
##
## Step:  AIC=26562.25
## GDP ~ Life.expectancy + Status + Adult.Mortality + infant.deaths +
##     Alcohol + Total.expenditure + percentage.expenditure + Hepatitis.B +
##     BMI + Polio + Diphtheria + Population + thinness..1.19.years +
##     thinness.5.9.years + Income.composition.of.resources + Schooling
##
```

```
##                                   Df  Sum of Sq        RSS   AIC
## - Alcohol                          1 5.9099e+05 1.5993e+10 26560
## - thinness..1.19.years             1 9.1247e+05 1.5994e+10 26560
## - Life.expectancy                  1 9.8623e+05 1.5994e+10 26560
## - Adult.Mortality                  1 2.7498e+06 1.5996e+10 26560
## - Diphtheria                       1 3.3603e+06 1.5996e+10 26561
## - Population                       1 3.8655e+06 1.5997e+10 26561
## - thinness.5.9.years               1 4.5979e+06 1.5997e+10 26561
## - infant.deaths                    1 6.6522e+06 1.5999e+10 26561
## - BMI                              1 7.1103e+06 1.6000e+10 26561
## - Hepatitis.B                      1 1.0245e+07 1.6003e+10 26561
## - Polio                            1 1.2270e+07 1.6005e+10 26562
## <none>                                          1.5993e+10 26562
## - Total.expenditure                1 2.3092e+07 1.6016e+10 26563
## + Measles                          1 6.1993e+04 1.5993e+10 26564
## + HIV.AIDS                         1 4.4543e+04 1.5993e+10 26564
## + under.five.deaths                1 1.3737e+04 1.5993e+10 26564
## - Status                           1 6.1874e+07 1.6055e+10 26567
## - Income.composition.of.resources  1 7.3180e+07 1.6066e+10 26568
## - Schooling                        1 1.0198e+08 1.6095e+10 26571
## - percentage.expenditure           1 1.2816e+11 1.4415e+11 30186
##
## Step:  AIC=26560.31
## GDP ~ Life.expectancy + Status + Adult.Mortality + infant.deaths +
##     Total.expenditure + percentage.expenditure + Hepatitis.B +
##     BMI + Polio + Diphtheria + Population + thinness..1.19.years +
##     thinness.5.9.years + Income.composition.of.resources + Schooling
##
##                                   Df  Sum of Sq        RSS   AIC
## - Life.expectancy                  1 7.9994e+05 1.5994e+10 26558
## - thinness..1.19.years             1 8.1835e+05 1.5994e+10 26558
## - Adult.Mortality                  1 3.0136e+06 1.5996e+10 26559
## - Diphtheria                       1 3.2364e+06 1.5997e+10 26559
## - Population                       1 3.9529e+06 1.5997e+10 26559
## - thinness.5.9.years               1 4.6558e+06 1.5998e+10 26559
## - infant.deaths                    1 7.1101e+06 1.6000e+10 26559
## - BMI                              1 7.1406e+06 1.6000e+10 26559
## - Hepatitis.B                      1 9.9854e+06 1.6003e+10 26559
## - Polio                            1 1.2536e+07 1.6006e+10 26560
## <none>                                          1.5993e+10 26560
## - Total.expenditure                1 2.2839e+07 1.6016e+10 26561
## + Alcohol                          1 5.9099e+05 1.5993e+10 26562
## + Measles                          1 5.9155e+04 1.5993e+10 26562
## + HIV.AIDS                         1 5.3829e+04 1.5993e+10 26562
## + under.five.deaths                1 5.2447e+04 1.5993e+10 26562
## - Income.composition.of.resources  1 7.7114e+07 1.6070e+10 26566
## - Status                           1 7.9619e+07 1.6073e+10 26566
## - Schooling                        1 1.1444e+08 1.6108e+10 26570
## - percentage.expenditure           1 1.2957e+11 1.4556e+11 30200
##
## Step:  AIC=26558.39
## GDP ~ Status + Adult.Mortality + infant.deaths + Total.expenditure +
##     percentage.expenditure + Hepatitis.B + BMI + Polio + Diphtheria +
##     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 8.0467e+05 1.5995e+10 26556
## - Adult.Mortality                  1 2.2528e+06 1.5996e+10 26557
## - Diphtheria                       1 3.0315e+06 1.5997e+10 26557
## - Population                       1 3.8304e+06 1.5998e+10 26557
## - thinness.5.9.years               1 4.7284e+06 1.5999e+10 26557
## - BMI                              1 6.6380e+06 1.6001e+10 26557
## - infant.deaths                    1 6.9259e+06 1.6001e+10 26557
## - Hepatitis.B                      1 9.9897e+06 1.6004e+10 26557
## - Polio                            1 1.2752e+07 1.6007e+10 26558
## <none>                                          1.5994e+10 26558
## - Total.expenditure                1 2.3075e+07 1.6017e+10 26559
## + Life.expectancy                  1 7.9994e+05 1.5993e+10 26560
## + Alcohol                          1 4.0470e+05 1.5994e+10 26560
## + HIV.AIDS                         1 6.9035e+04 1.5994e+10 26560
## + Measles                          1 5.1936e+04 1.5994e+10 26560
## + under.five.deaths                1 1.1600e+03 1.5994e+10 26560
## - Status                           1 7.9966e+07 1.6074e+10 26565
## - Income.composition.of.resources  1 8.6777e+07 1.6081e+10 26565
## - Schooling                        1 1.2908e+08 1.6123e+10 26570
## - percentage.expenditure           1 1.3159e+11 1.4759e+11 30221
##
## Step:  AIC=26556.48
## GDP ~ Status + Adult.Mortality + infant.deaths + Total.expenditure +
##     percentage.expenditure + Hepatitis.B + BMI + Polio + Diphtheria +
##     Population + thinness.5.9.years + Income.composition.of.resources +
##     Schooling
##
##                                   Df  Sum of Sq        RSS   AIC
## - Adult.Mortality                  1 2.1517e+06 1.5997e+10 26555
## - Diphtheria                       1 3.1578e+06 1.5998e+10 26555
## - Population                       1 3.7395e+06 1.5999e+10 26555
## - BMI                              1 6.8962e+06 1.6002e+10 26555
## - infant.deaths                    1 7.3189e+06 1.6002e+10 26555
## - thinness.5.9.years               1 7.7985e+06 1.6003e+10 26555
## - Hepatitis.B                      1 1.0170e+07 1.6005e+10 26556
## - Polio                            1 1.3167e+07 1.6008e+10 26556
## <none>                                          1.5995e+10 26556
## - Total.expenditure                1 2.2992e+07 1.6018e+10 26557
## + thinness..1.19.years             1 8.0467e+05 1.5994e+10 26558
## + Life.expectancy                  1 7.8626e+05 1.5994e+10 26558
## + Alcohol                          1 3.3047e+05 1.5995e+10 26558
## + HIV.AIDS                         1 6.5999e+04 1.5995e+10 26558
## + Measles                          1 5.8992e+04 1.5995e+10 26558
## + under.five.deaths                1 3.0320e+03 1.5995e+10 26558
## - Status                           1 7.9939e+07 1.6075e+10 26563
## - Income.composition.of.resources  1 8.6172e+07 1.6081e+10 26563
## - Schooling                        1 1.2827e+08 1.6123e+10 26568
## - percentage.expenditure           1 1.3161e+11 1.4761e+11 30219
##
## Step:  AIC=26554.7
## GDP ~ Status + infant.deaths + Total.expenditure + percentage.expenditure +
```

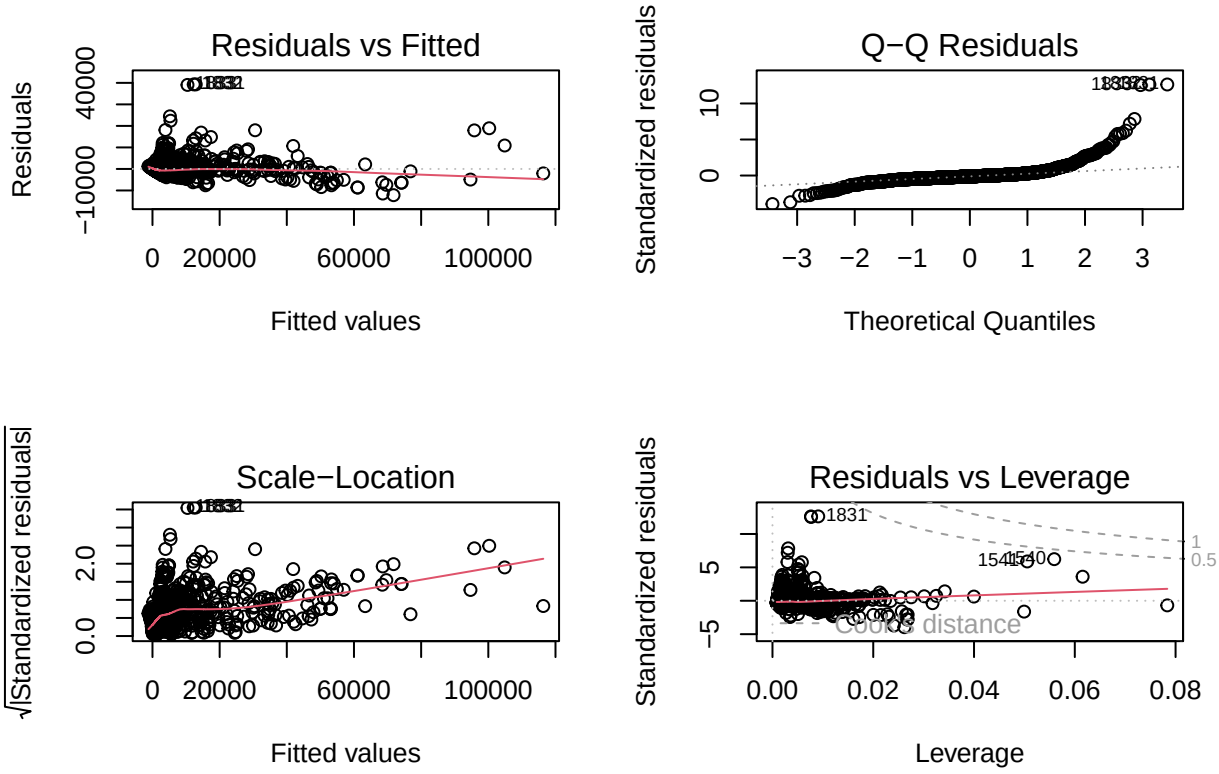
```
##     Hepatitis.B + BMI + Polio + Diphtheria + Population + thinness.5.9.years +
##     Income.composition.of.resources + Schooling
##
##                                    Df  Sum of Sq        RSS   AIC
## - Diphtheria                        1 3.2348e+06 1.6000e+10 26553
## - Population                        1 3.6979e+06 1.6001e+10 26553
## - infant.deaths                     1 6.7733e+06 1.6004e+10 26553
## - thinness.5.9.years                1 7.2627e+06 1.6004e+10 26553
## - BMI                               1 7.8706e+06 1.6005e+10 26554
## - Hepatitis.B                       1 1.0199e+07 1.6007e+10 26554
## - Polio                             1 1.2717e+07 1.6010e+10 26554
## <none>                                           1.5997e+10 26555
## - Total.expenditure                 1 2.2515e+07 1.6020e+10 26555
## + Adult.Mortality                   1 2.1517e+06 1.5995e+10 26556
## + Alcohol                           1 7.7561e+05 1.5996e+10 26557
## + thinness..1.19.years              1 7.0356e+05 1.5996e+10 26557
## + HIV.AIDS                          1 2.5873e+05 1.5997e+10 26557
## + under.five.deaths                 1 9.7304e+04 1.5997e+10 26557
## + Measles                           1 7.9230e+04 1.5997e+10 26557
## + Life.expectancy                   1 3.3698e+04 1.5997e+10 26557
## - Status                            1 7.9000e+07 1.6076e+10 26561
## - Income.composition.of.resources   1 8.4029e+07 1.6081e+10 26561
## - Schooling                         1 1.2664e+08 1.6124e+10 26566
## - percentage.expenditure            1 1.3175e+11 1.4775e+11 30219
##
## Step:  AIC=26553.03
## GDP ~ Status + infant.deaths + Total.expenditure + percentage.expenditure +
##     Hepatitis.B + BMI + Polio + Population + thinness.5.9.years +
##     Income.composition.of.resources + Schooling
##
##                                    Df  Sum of Sq        RSS   AIC
## - Population                        1 4.0209e+06 1.6004e+10 26551
## - infant.deaths                     1 6.9353e+06 1.6007e+10 26552
## - thinness.5.9.years                1 7.1294e+06 1.6007e+10 26552
## - Hepatitis.B                       1 7.1762e+06 1.6008e+10 26552
## - BMI                               1 7.3060e+06 1.6008e+10 26552
## - Polio                             1 9.6013e+06 1.6010e+10 26552
## <none>                                           1.6000e+10 26553
## - Total.expenditure                 1 2.2802e+07 1.6023e+10 26553
## + Diphtheria                        1 3.2348e+06 1.5997e+10 26555
## + Adult.Mortality                   1 2.2286e+06 1.5998e+10 26555
## + thinness..1.19.years              1 8.2166e+05 1.6000e+10 26555
## + Alcohol                           1 6.6680e+05 1.6000e+10 26555
## + HIV.AIDS                          1 2.7412e+05 1.6000e+10 26555
## + under.five.deaths                 1 2.4379e+05 1.6000e+10 26555
## + Measles                           1 1.1008e+05 1.6000e+10 26555
## + Life.expectancy                   1 8.9328e+04 1.6000e+10 26555
## - Status                            1 7.9580e+07 1.6080e+10 26559
## - Income.composition.of.resources   1 8.1425e+07 1.6082e+10 26559
## - Schooling                         1 1.2517e+08 1.6126e+10 26564
## - percentage.expenditure            1 1.3180e+11 1.4780e+11 30217
##
## Step:  AIC=26551.45
## GDP ~ Status + infant.deaths + Total.expenditure + percentage.expenditure +
```

```
##     Hepatitis.B + BMI + Polio + thinness.5.9.years + Income.composition.of.resources +
##     Schooling
##
##                                   Df  Sum of Sq        RSS   AIC
## - infant.deaths                    1 3.1092e+06 1.6007e+10 26550
## - Hepatitis.B                      1 7.2245e+06 1.6012e+10 26550
## - thinness.5.9.years               1 7.4161e+06 1.6012e+10 26550
## - BMI                              1 7.8099e+06 1.6012e+10 26550
## - Polio                            1 9.1541e+06 1.6014e+10 26550
## <none>                                          1.6004e+10 26551
## - Total.expenditure                1 2.2685e+07 1.6027e+10 26552
## + Population                       1 4.0209e+06 1.6000e+10 26553
## + Diphtheria                       1 3.5578e+06 1.6001e+10 26553
## + Adult.Mortality                  1 2.1882e+06 1.6002e+10 26553
## + Alcohol                          1 7.6900e+05 1.6004e+10 26553
## + thinness..1.19.years             1 7.3352e+05 1.6004e+10 26553
## + under.five.deaths                1 6.6606e+05 1.6004e+10 26553
## + HIV.AIDS                         1 2.9820e+05 1.6004e+10 26553
## + Life.expectancy                  1 1.2450e+05 1.6004e+10 26553
## + Measles                          1 4.8634e+04 1.6004e+10 26553
## - Status                           1 8.0497e+07 1.6085e+10 26558
## - Income.composition.of.resources  1 8.1559e+07 1.6086e+10 26558
## - Schooling                        1 1.2254e+08 1.6127e+10 26562
## - percentage.expenditure           1 1.3180e+11 1.4780e+11 30215
##
## Step:  AIC=26549.77
## GDP ~ Status + Total.expenditure + percentage.expenditure + Hepatitis.B +
##     BMI + Polio + thinness.5.9.years + Income.composition.of.resources +
##     Schooling
##
##                                   Df  Sum of Sq        RSS   AIC
## - thinness.5.9.years               1 4.8231e+06 1.6012e+10 26548
## - Hepatitis.B                      1 5.8403e+06 1.6013e+10 26548
## - BMI                              1 7.5995e+06 1.6015e+10 26548
## - Polio                            1 8.9634e+06 1.6016e+10 26549
## <none>                                          1.6007e+10 26550
## - Total.expenditure                1 2.3459e+07 1.6031e+10 26550
## + Diphtheria                       1 3.4617e+06 1.6004e+10 26551
## + under.five.deaths                1 3.3433e+06 1.6004e+10 26551
## + infant.deaths                    1 3.1092e+06 1.6004e+10 26551
## + Adult.Mortality                  1 1.7236e+06 1.6006e+10 26552
## + thinness..1.19.years             1 1.1261e+06 1.6006e+10 26552
## + Alcohol                          1 1.0180e+06 1.6006e+10 26552
## + Measles                          1 5.0265e+05 1.6007e+10 26552
## + Population                       1 1.9482e+05 1.6007e+10 26552
## + HIV.AIDS                         1 1.6248e+05 1.6007e+10 26552
## + Life.expectancy                  1 8.3662e+04 1.6007e+10 26552
## - Status                           1 8.1911e+07 1.6089e+10 26556
## - Income.composition.of.resources  1 8.6568e+07 1.6094e+10 26557
## - Schooling                        1 1.2053e+08 1.6128e+10 26560
## - percentage.expenditure           1 1.3179e+11 1.4780e+11 30213
##
## Step:  AIC=26548.26
## GDP ~ Status + Total.expenditure + percentage.expenditure + Hepatitis.B +
```

```
##     BMI + Polio + Income.composition.of.resources + Schooling
##
##                                  Df  Sum of Sq        RSS   AIC
## - BMI                             1 4.2981e+06 1.6017e+10 26547
## - Hepatitis.B                     1 6.0564e+06 1.6018e+10 26547
## - Polio                           1 8.9424e+06 1.6021e+10 26547
## <none>                                         1.6012e+10 26548
## - Total.expenditure               1 2.1696e+07 1.6034e+10 26548
## + thinness.5.9.years              1 4.8231e+06 1.6007e+10 26550
## + Diphtheria                      1 3.3998e+06 1.6009e+10 26550
## + thinness..1.19.years            1 2.1401e+06 1.6010e+10 26550
## + Alcohol                         1 1.5156e+06 1.6011e+10 26550
## + Adult.Mortality                 1 1.5102e+06 1.6011e+10 26550
## + Population                      1 1.1221e+06 1.6011e+10 26550
## + under.five.deaths               1 6.3183e+05 1.6012e+10 26550
## + infant.deaths                   1 5.1626e+05 1.6012e+10 26550
## + Measles                         1 2.3819e+05 1.6012e+10 26550
## + HIV.AIDS                        1 7.6652e+04 1.6012e+10 26550
## + Life.expectancy                 1 1.4796e+04 1.6012e+10 26550
## - Status                          1 8.4362e+07 1.6097e+10 26555
## - Income.composition.of.resources  1 8.9500e+07 1.6102e+10 26556
## - Schooling                       1 1.2537e+08 1.6138e+10 26559
## - percentage.expenditure          1 1.3203e+11 1.4804e+11 30214
##
## Step:  AIC=26546.71
## GDP ~ Status + Total.expenditure + percentage.expenditure + Hepatitis.B +
##     Polio + Income.composition.of.resources + Schooling
##
##                                  Df  Sum of Sq        RSS   AIC
## - Hepatitis.B                     1 5.7276e+06 1.6022e+10 26545
## - Polio                           1 9.4022e+06 1.6026e+10 26546
## <none>                                         1.6017e+10 26547
## - Total.expenditure               1 2.3171e+07 1.6040e+10 26547
## + BMI                             1 4.2981e+06 1.6012e+10 26548
## + Diphtheria                      1 2.9527e+06 1.6014e+10 26548
## + Adult.Mortality                 1 2.2457e+06 1.6014e+10 26548
## + Alcohol                         1 1.5605e+06 1.6015e+10 26548
## + thinness.5.9.years              1 1.5218e+06 1.6015e+10 26548
## + under.five.deaths               1 1.1902e+06 1.6015e+10 26549
## + infant.deaths                   1 1.0251e+06 1.6016e+10 26549
## + Population                      1 8.3016e+05 1.6016e+10 26549
## + Measles                         1 5.0682e+05 1.6016e+10 26549
## + thinness..1.19.years            1 3.7389e+05 1.6016e+10 26549
## + Life.expectancy                 1 3.1464e+05 1.6016e+10 26549
## + HIV.AIDS                        1 2.4126e+05 1.6016e+10 26549
## - Status                          1 8.4354e+07 1.6101e+10 26553
## - Income.composition.of.resources  1 8.5665e+07 1.6102e+10 26554
## - Schooling                       1 1.2199e+08 1.6139e+10 26557
## - percentage.expenditure          1 1.3207e+11 1.4808e+11 30212
##
## Step:  AIC=26545.3
## GDP ~ Status + Total.expenditure + percentage.expenditure + Polio +
##     Income.composition.of.resources + Schooling
##
```

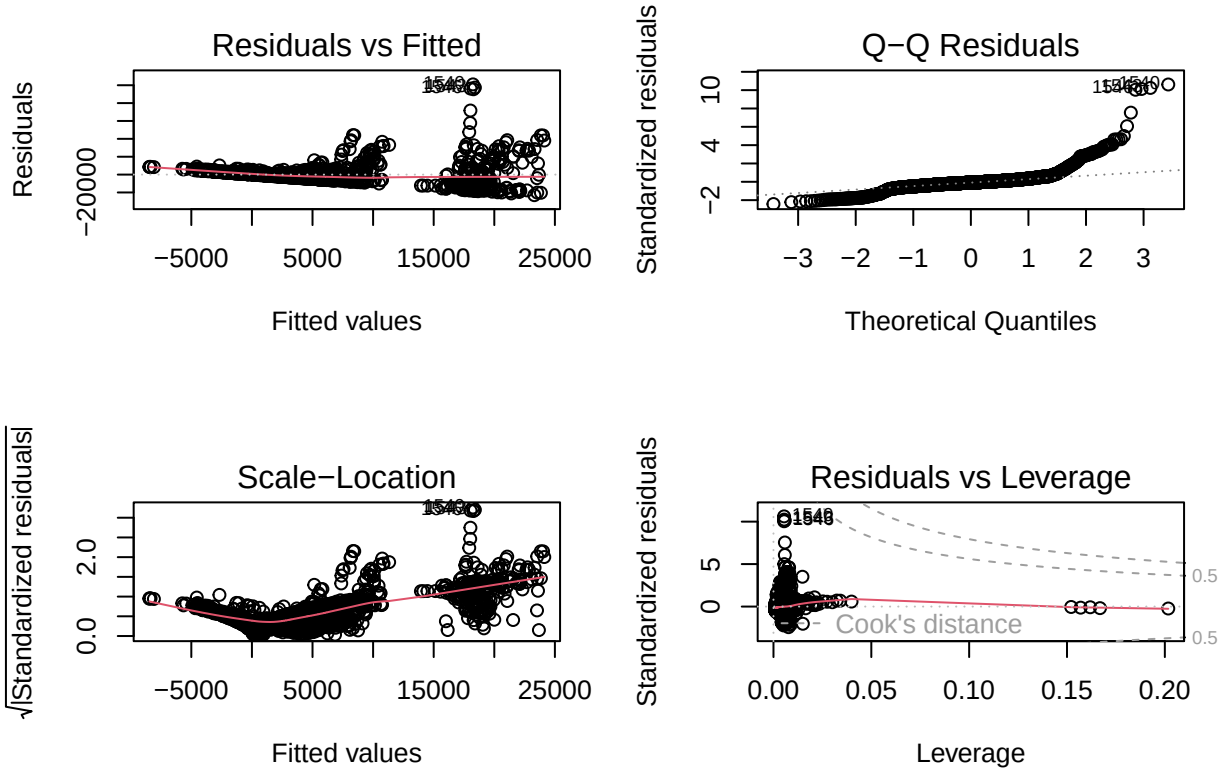
```
##                                   Df  Sum of Sq        RSS   AIC
## <none>                                           1.6022e+10 26545
## - Polio                            1 2.0134e+07 1.6042e+10 26545
## - Total.expenditure                1 2.1914e+07 1.6044e+10 26546
## + Hepatitis.B                      1 5.7276e+06 1.6017e+10 26547
## + BMI                              1 3.9694e+06 1.6018e+10 26547
## + Adult.Mortality                  1 2.2967e+06 1.6020e+10 26547
## + thinness.5.9.years               1 1.7100e+06 1.6021e+10 26547
## + Population                       1 1.4084e+06 1.6021e+10 26547
## + Alcohol                          1 1.2101e+06 1.6021e+10 26547
## + thinness..1.19.years             1 4.7062e+05 1.6022e+10 26547
## + under.five.deaths                1 4.3252e+05 1.6022e+10 26547
## + infant.deaths                    1 3.4607e+05 1.6022e+10 26547
## + Diphtheria                       1 2.5765e+05 1.6022e+10 26547
## + Life.expectancy                  1 2.3613e+05 1.6022e+10 26547
## + Measles                          1 2.1471e+05 1.6022e+10 26547
## + HIV.AIDS                         1 1.4599e+05 1.6022e+10 26547
## - Income.composition.of.resources  1 8.5900e+07 1.6108e+10 26552
## - Status                           1 8.6874e+07 1.6109e+10 26552
## - Schooling                        1 1.2421e+08 1.6147e+10 26556
## - percentage.expenditure           1 1.3320e+11 1.4923e+11 30223

##
## Call:
## lm(formula = GDP ~ Status + Total.expenditure + percentage.expenditure +
##     Polio + Income.composition.of.resources + Schooling, data = all_data)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -12186  -1126   -375    411  39287
##
## Coefficients:
##                                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)                    -1.406e+03  5.924e+02  -2.374  0.01773 *
## StatusDeveloping               -8.002e+02  2.682e+02  -2.984  0.00289 **
## Total.expenditure              -5.207e+01  3.475e+01  -1.499  0.13417
## percentage.expenditure          5.988e+00  5.125e-02 116.838  < 2e-16 ***
## Polio                           5.278e+00  3.674e+00   1.436  0.15106
## Income.composition.of.resources  2.041e+03  6.878e+02   2.967  0.00305 **
## Schooling                       1.691e+02  4.740e+01   3.568  0.00037 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3124 on 1642 degrees of freedom
## Multiple R-squared:  0.9262, Adjusted R-squared:  0.9259
## F-statistic:  3433 on 6 and 1642 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = GDP ~ Status + Total.expenditure + Polio + percentage.expenditure +
##     Income.composition.of.resources + Schooling, data = all_data)
##
## Residuals:
##    Min     1Q Median     3Q    Max
```

```
## -12186  -1126   -375    411  39287
##
## Coefficients:
##                                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)                    -1.406e+03  5.924e+02  -2.374  0.01773 *
## StatusDeveloping               -8.002e+02  2.682e+02  -2.984  0.00289 **
## Total.expenditure              -5.207e+01  3.475e+01  -1.499  0.13417
## Polio                           5.278e+00  3.674e+00   1.436  0.15106
## percentage.expenditure          5.988e+00  5.125e-02 116.838  < 2e-16 ***
## Income.composition.of.resources 2.041e+03  6.878e+02   2.967  0.00305 **
## Schooling                       1.691e+02  4.740e+01   3.568  0.00037 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3124 on 1642 degrees of freedom
## Multiple R-squared:  0.9262, Adjusted R-squared:  0.9259
## F-statistic:  3433 on 6 and 1642 DF,  p-value: < 2.2e-16
```




```
##
## Call:
## lm(formula = GDP ~ Status + Total.expenditure + Polio + Population +
##     Income.composition.of.resources + Schooling, data = all_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
```

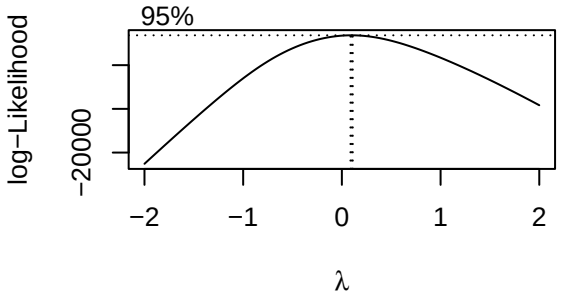
```
## -23023  -3267   -798   1578 100934
##
## Coefficients:
##                                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)                    -1.305e+03  1.812e+03  -0.720   0.4714
## StatusDeveloping               -1.022e+04  7.807e+02 -13.084  < 2e-16 ***
## Total.expenditure               2.506e+02  1.060e+02   2.364   0.0182 *
## Polio                          -1.293e+01  1.121e+01  -1.153   0.2490
## Population                      3.111e-07  3.349e-06   0.093   0.9260
## Income.composition.of.resources  1.006e+04  2.090e+03   4.811 1.64e-06 ***
## Schooling                       7.276e+02  1.440e+02   5.053 4.83e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9533 on 1642 degrees of freedom
## Multiple R-squared:  0.3124, Adjusted R-squared:  0.3099
## F-statistic: 124.4 on 6 and 1642 DF,  p-value: < 2.2e-16
```

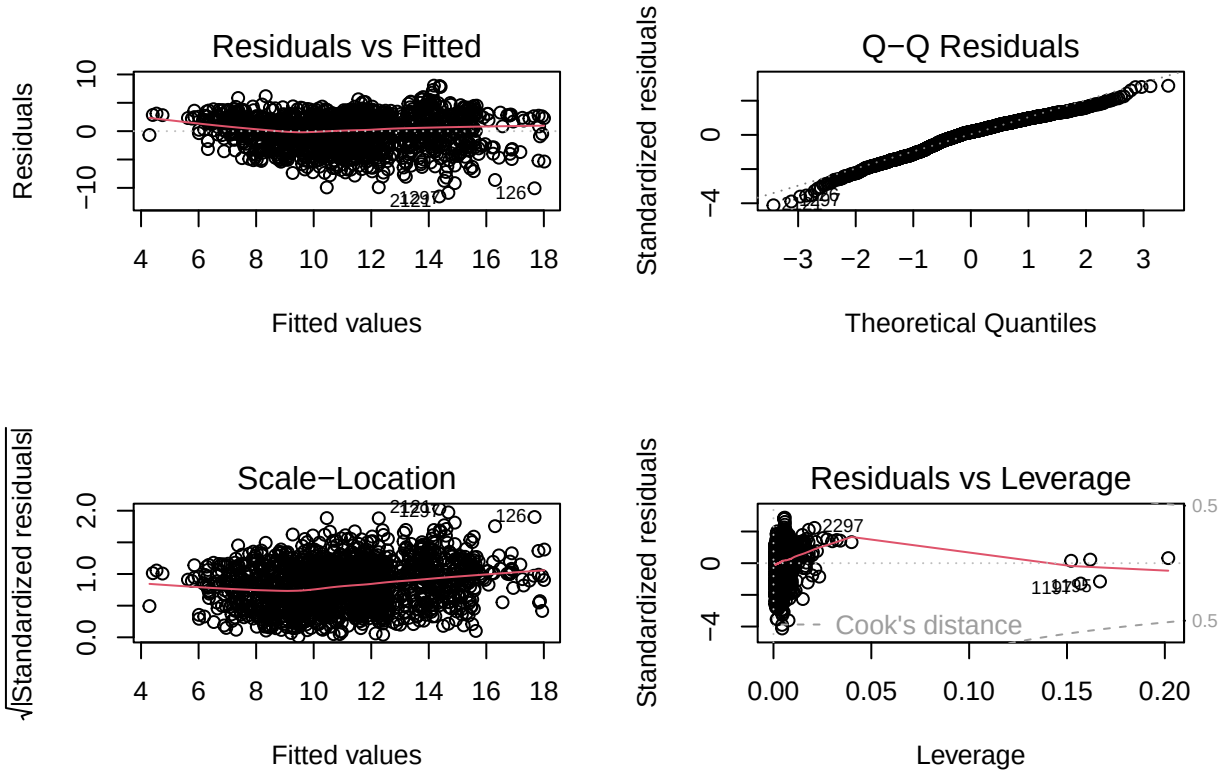



```
## [1] 0.1010101
```

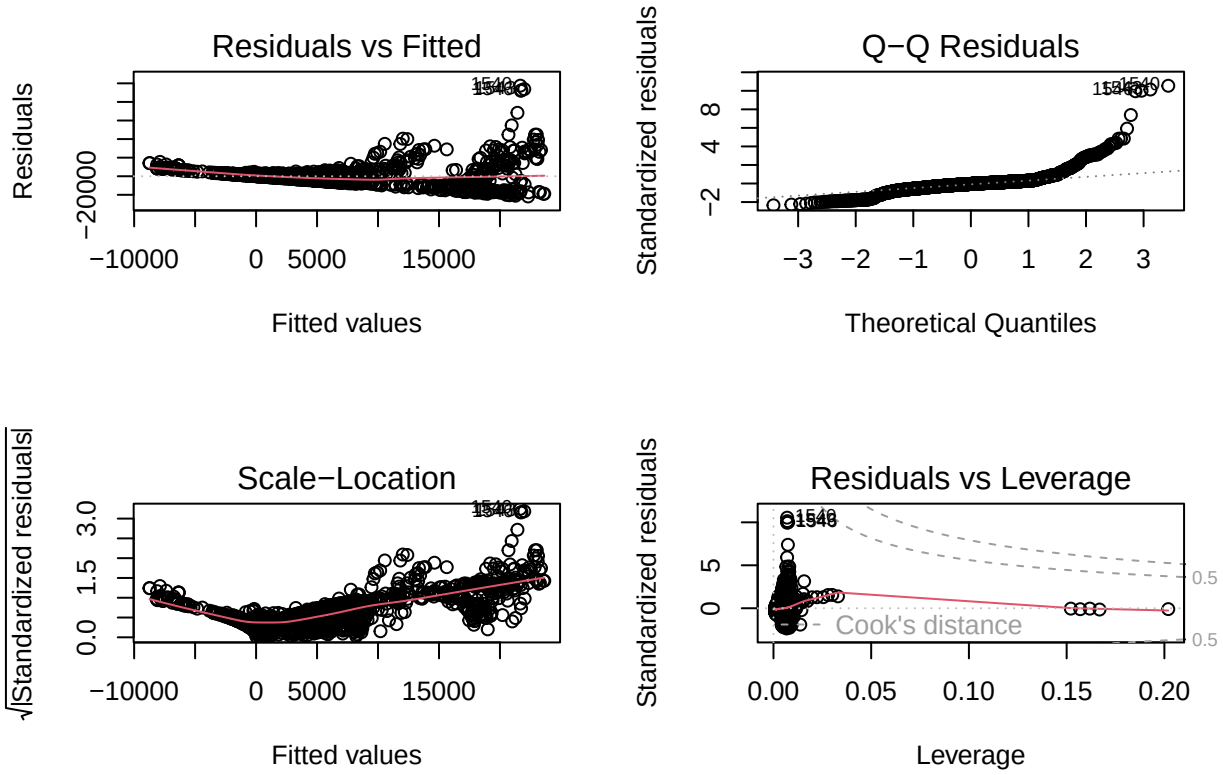
```
##
## Call:
## lm(formula = bc_GDP ~ Status + Total.expenditure + Polio + Population +
##     Income.composition.of.resources + Schooling, data = all_data)
##
```

```
## Residuals:
##      Min       1Q   Median       3Q      Max
## -11.5140  -1.7886   0.4771   1.9855   8.0242
##
## Coefficients:
##                                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)                     3.742e+00  5.323e-01   7.029 3.04e-12 ***
## StatusDeveloping               -1.484e+00  2.294e-01  -6.470 1.29e-10 ***
## Total.expenditure               3.593e-02  3.115e-02   1.153    0.249
## Polio                          -4.012e-03  3.294e-03  -1.218    0.223
## Population                     -3.108e-10  9.840e-10  -0.316    0.752
## Income.composition.of.resources  4.106e+00  6.141e-01   6.685 3.15e-11 ***
## Schooling                       5.124e-01  4.231e-02  12.110  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.801 on 1642 degrees of freedom
## Multiple R-squared:  0.4209, Adjusted R-squared:  0.4188
## F-statistic: 198.9 on 6 and 1642 DF,  p-value: < 2.2e-16
```

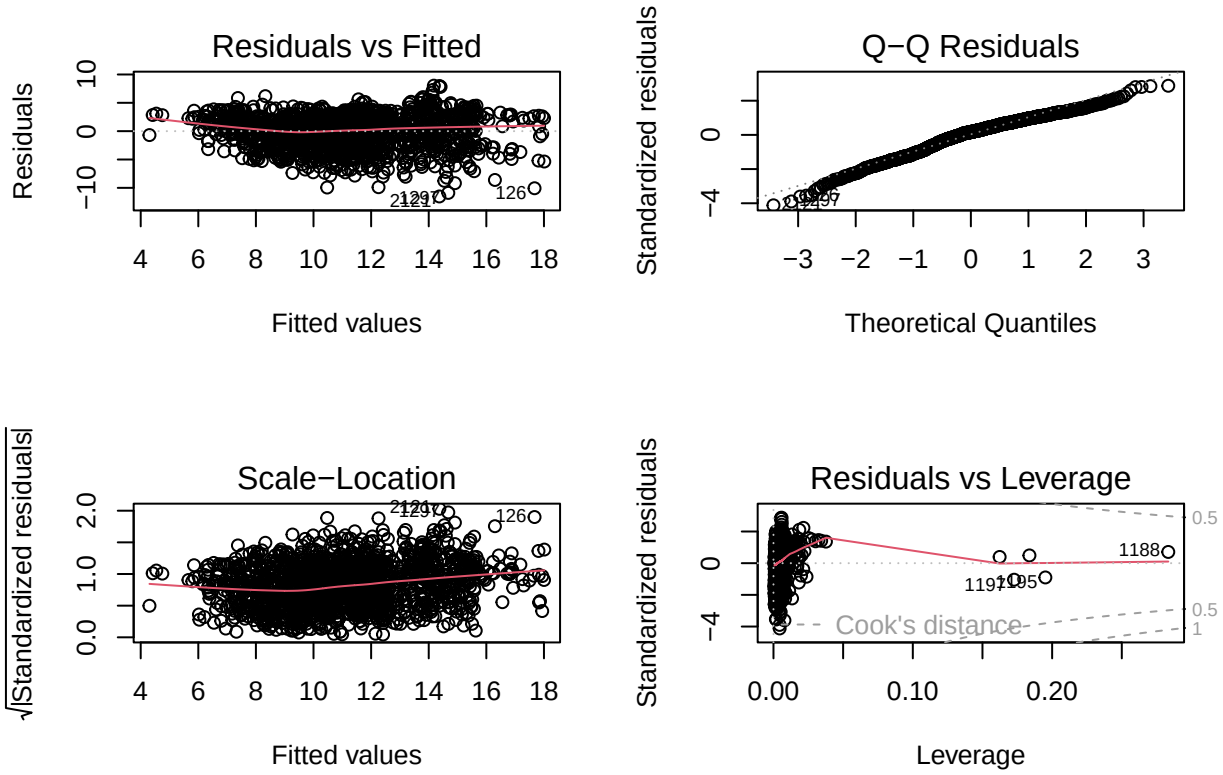




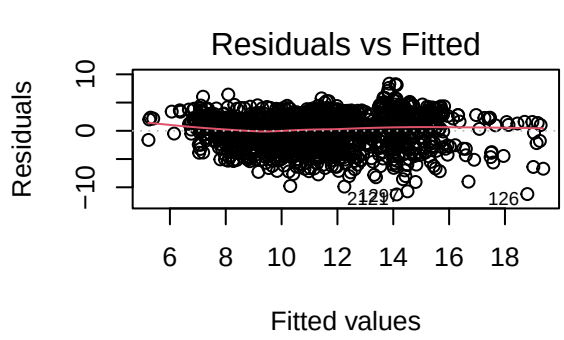

```
##
## Call:
## lm(formula = GDP ~ Status + Total.expenditure + I(Polio^2) +
##     Population + I(Income.composition.of.resources^2) + Schooling,
##     data = all_data)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -21751  -3347   -430   1704  97502
##
## Coefficients:
##                                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)                       4.279e+03  1.759e+03   2.433  0.01509 *
## StatusDeveloping                 -8.426e+03  7.829e+02 -10.762  < 2e-16 ***
## Total.expenditure                 2.763e+02  1.033e+02   2.676  0.00753 **
## I(Polio^2)                       -2.033e-01  9.635e-02  -2.110  0.03501 *
## Population                       -9.121e-08  3.262e-06  -0.028  0.97769
## I(Income.composition.of.resources^2)  2.630e+04  2.454e+03  10.717  < 2e-16 ***
## Schooling                        -2.489e+02  1.710e+02  -1.455  0.14576
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9281 on 1642 degrees of freedom
## Multiple R-squared:  0.3483, Adjusted R-squared:  0.3459
## F-statistic: 146.3 on 6 and 1642 DF,  p-value: < 2.2e-16
```

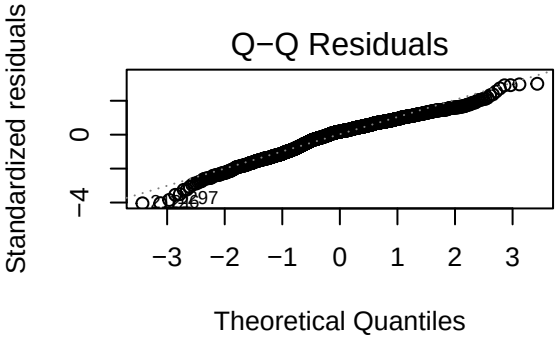


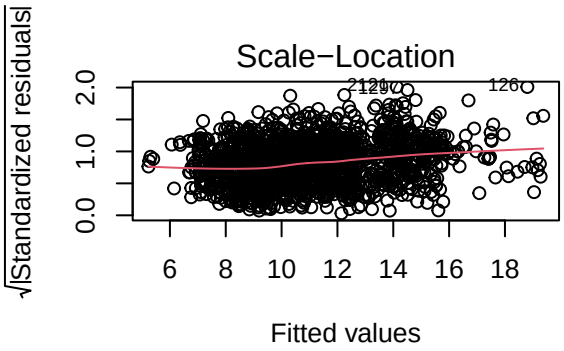

```
##
## Call:
## lm(formula = bc_GDP ~ Status + Total.expenditure + I(Polio^2) +
##     I(Population^2) + Income.composition.of.resources + Schooling,
##     data = all_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -11.5154  -1.8079   0.4799   1.9878   8.0250
##
## Coefficients:
##                                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)                     3.624e+00  5.115e-01   7.084 2.07e-12 ***
## StatusDeveloping               -1.483e+00  2.294e-01  -6.464 1.34e-10 ***
## Total.expenditure               3.557e-02  3.110e-02   1.144    0.253
## I(Polio^2)                     -2.791e-05  2.898e-05  -0.963    0.336
## I(Population^2)                -7.755e-19  8.933e-19  -0.868    0.385
## Income.composition.of.resources  4.111e+00  6.150e-01   6.684 3.17e-11 ***
## Schooling                        5.114e-01  4.253e-02  12.025  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.801 on 1642 degrees of freedom
## Multiple R-squared:  0.4209, Adjusted R-squared:  0.4188
## F-statistic: 198.9 on 6 and 1642 DF,  p-value: < 2.2e-16
```

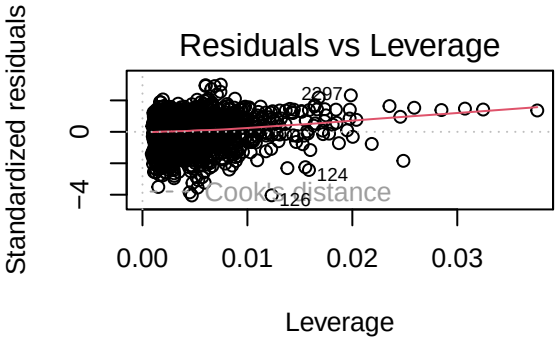



```
##
## Call:
## lm(formula = bc_GDP ~ Status + I(Total.expenditure^2) + Polio +
##     I(log(Population)) + Income.composition.of.resources + I(Schooling^2),
##     data = all_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -11.2678  -1.8229   0.5069   1.9800   8.3447
##
## Coefficients:
##                                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)                      6.227949   0.603082  10.327  < 2e-16 ***
## StatusDeveloping                -1.175649   0.235843  -4.985 6.86e-07 ***
## I(Total.expenditure^2)           0.003817   0.002451   1.557    0.120
## Polio                           -0.003145   0.003273  -0.961    0.337
## I(log(Population))              -0.001182   0.025241  -0.047    0.963
## Income.composition.of.resources  4.273179   0.596040   7.169 1.14e-12 ***
## I(Schooling^2)                   0.021669   0.001756  12.342  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.792 on 1642 degrees of freedom
## Multiple R-squared:  0.4249, Adjusted R-squared:  0.4228
## F-statistic: 202.2 on 6 and 1642 DF,  p-value: < 2.2e-16
```





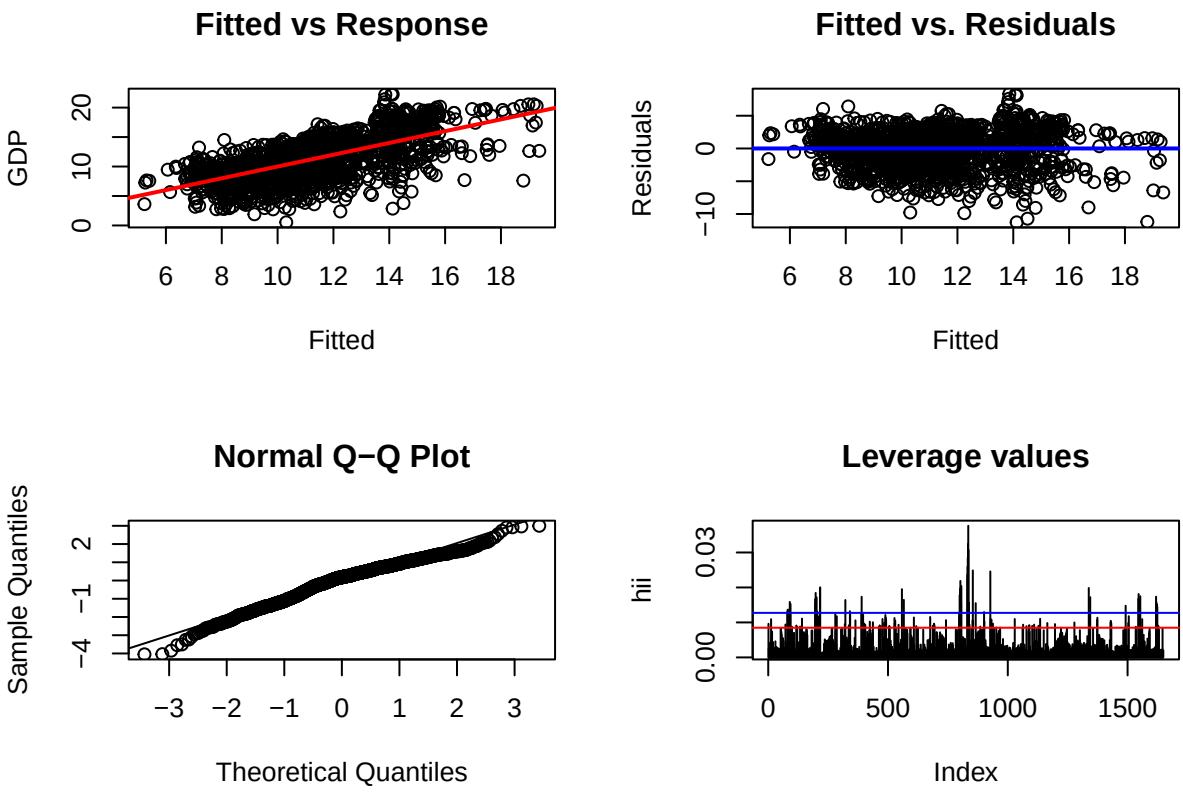





```
##                            Status          I(Total.expenditure^2)
##                          1.473847                        1.102295
##                            Polio             I(log(Population))
##                          1.141679                        1.017460
## Income.composition.of.resources                I(Schooling^2)
##                          2.518552                        2.985993
```

```
##        df       AIC
## model1  8 31226.955
## model2  8 34906.658
## model3  8  8085.575
## model4  8 34818.269
## model5  8  8085.524
## model6  8  8074.323
```

```
##        df       BIC
## model1  8 31270.218
## model2  8 34949.922
## model3  8  8128.838
## model4  8 34861.533
## model5  8  8128.788
## model6  8  8117.587
```




```
##           1           2           3           4           5           6
## 0.009609219 0.002502358 0.003152583 0.002568135 0.002045879 0.003627632
##           7           8           9          10          11          12
## 0.004213244 0.002836527 0.002753811 0.002642620 0.003956701 0.010929435
##          13          14          15          16          17          18
## 0.005711224 0.005771848 0.005452873 0.007390880 0.002651616 0.001806698
##          19          20          21          22          23          24
## 0.001871189 0.004416614 0.001548238 0.001644545 0.001580165 0.001634759
##          25          26          27          28          29          30
## 0.002691310 0.001720574 0.002079181 0.002004114 0.002026520 0.004597574
##          31          32          34          35          36          37
## 0.002810232 0.002633228 0.002977748 0.002947267 0.002895464 0.002717448
##          38          39          40          41          42          43
## 0.002513735 0.001336470 0.001490713 0.002576629 0.002588202 0.002420305
##          44          50          51          52          53          54
## 0.001543602 0.001611473 0.001411562 0.001632101 0.002201189 0.002365332
##          55          56          57          82          83          84
## 0.002445414 0.002067262 0.002246276 0.008256696 0.008197590 0.006694289
##          85          86          87          88          89          90
## 0.007315007 0.006478945 0.004380211 0.004284175 0.004305255 0.003914826
##          91          92          93          94          98          99
## 0.005428852 0.005448670 0.004801477 0.004587850 0.002719195 0.001771406
##         100         101         102         103         104         105
## 0.001687262 0.001876886 0.001663930 0.001801389 0.002810356 0.009410302
##         106         107         108         109         110         111
## 0.002788809 0.001729544 0.004294330 0.002677159 0.001668562 0.002319243
```

```
##          112          114          115          116          117          118
## 0.0013498326 0.0130599878 0.0136271916 0.0127659500 0.0106283621 0.0095819422
##          119          120          121          122          123          124
## 0.0085517736 0.0083473557 0.0088530550 0.0136296699 0.0138113431 0.0158674516
##          125          126          127          130          131          132
## 0.0146461757 0.0123073404 0.0152718800 0.0083569464 0.0082703483 0.0083412675
##          133          134          135          136          137          138
## 0.0064839906 0.0081610331 0.0087583019 0.0066350928 0.0066055265 0.0066606565
##          139          140          141          142          143          144
## 0.0065559430 0.0066253708 0.0066031049 0.0068829175 0.0066216129 0.0070323912
##          146          147          148          149          150          151
## 0.0017662157 0.0018553154 0.0021380891 0.0018638960 0.0017093940 0.0019347709
##          152          153          154          155          156          157
## 0.0023213819 0.0020541440 0.0091108529 0.0018096251 0.0038086303 0.0019771059
##          158          194          195          196          197          198
## 0.0087983152 0.0026338866 0.0039149078 0.0022701473 0.0040537610 0.0027377090
##          199          200          201          202          203          204
## 0.0028322369 0.0031043519 0.0044079760 0.0026764269 0.0031708481 0.0029179571
##          205          226          227          228          229          230
## 0.0088206120 0.0036990697 0.0035511477 0.0037472195 0.0036756329 0.0030088884
##          231          232          233          234          235          236
## 0.0026455317 0.0029501669 0.0111018829 0.0019014428 0.0022932197 0.0015804522
##          237          238          239          240          242          243
## 0.0032814062 0.0018398779 0.0017360802 0.0011892161 0.0072332198 0.0068717228
##          244          245          246          247          248          249
## 0.0068274899 0.0065647372 0.0065313033 0.0064601866 0.0054107570 0.0062482152
##          250          251          252          253          254          255
## 0.0047975603 0.0048268133 0.0080710949 0.0075722329 0.0078950513 0.0067150401
##          256          258          259          260          261          262
## 0.0063736878 0.0012303555 0.0012346474 0.0022518247 0.0012980286 0.0021622355
##          263          264          265          266          267          268
## 0.0013221561 0.0019657057 0.0024144436 0.0025839261 0.0015604734 0.0025549920
##          269          270          271          272          274          275
## 0.0024911187 0.0025487896 0.0016426785 0.0016240300 0.0012610934 0.0029313255
##          276          277          278          279          280          281
## 0.0076978859 0.0017620798 0.0016576707 0.0076960472 0.0018542113 0.0019374320
##          282          283          284          285          286          290
## 0.0018780549 0.0019303095 0.0040881503 0.0020547352 0.0024662673 0.0017419254
##          291          292          293          294          295          296
## 0.0016967851 0.0016589739 0.0032030346 0.0166341296 0.0154030007 0.0184352775
##          297          298          299          300          301          302
## 0.0140519193 0.0136514388 0.0130700280 0.0171556575 0.0124014631 0.0122453055
##          303          304          322          323          324          325
## 0.0130691323 0.0117511371 0.0038857214 0.0030740060 0.0043003887 0.0034584148
##          326          327          328          329          330          331
## 0.0115616840 0.0116504735 0.0021105538 0.0040456884 0.0018347244 0.0197595046
##          332          338          339          340          341          342
## 0.0200396748 0.0012526951 0.0013173248 0.0012046822 0.0013339770 0.0012803404
##          343          344          345          346          347          348
## 0.0010830434 0.0010895627 0.0012218163 0.0011670812 0.0010661820 0.0012903641
##          349          350          351          352          354          355
## 0.0015234064 0.0011843525 0.0011805027 0.0016043474 0.0038962859 0.0022502059
##          356          357          358          359          360          361
## 0.0020477864 0.0051663615 0.0045352245 0.0048474079 0.0026720180 0.0027208538
```

```
##          362          363          364          365          366          367
## 0.0028676340 0.0044957321 0.0042573003 0.0047775507 0.0021324061 0.0018843414
##          368          386          387          388          389          390
## 0.0042017240 0.0047680176 0.0047718625 0.0045576637 0.0047783198 0.0049567391
##          391          392          393          394          395          396
## 0.0050302618 0.0050625366 0.0052906915 0.0058646403 0.0053848799 0.0053393993
##          397          398          399          400          402          403
## 0.0058178577 0.0057440311 0.0061848326 0.0055175524 0.0030784863 0.0025066297
##          404          405          406          407          408          409
## 0.0079378766 0.0082980518 0.0083063137 0.0039800679 0.0045509008 0.0043007899
##          410          418          419          420          421          422
## 0.0049826520 0.0024602872 0.0033551544 0.0030187118 0.0037138500 0.0039413587
##          423          424          425          426          427          428
## 0.0031869283 0.0040033482 0.0043687108 0.0123122052 0.0075177074 0.0042273357
##          450          451          452          453          454          455
## 0.0016141640 0.0039937933 0.0014784145 0.0117662737 0.0020617548 0.0015155589
##          456          457          458          459          460          461
## 0.0015792110 0.0014318927 0.0019011438 0.0012392575 0.0011016037 0.0018822723
##          462          466          467          468          469          470
## 0.0018277344 0.0011963651 0.0010497941 0.0014352980 0.0014883217 0.0013223238
##          471          472          473          474          482          483
## 0.0027074217 0.0014904968 0.0018053205 0.0079608336 0.0013167035 0.0020036907
##          484          485          486          487          488          489
## 0.0012794236 0.0081682186 0.0012398280 0.0019262706 0.0029840883 0.0024637274
##          490          491          498          499          500          501
## 0.0023131182 0.0017507961 0.0061807726 0.0061102422 0.0052137377 0.0052051423
##          502          503          504          505          506          507
## 0.0080759941 0.0095103729 0.0059656673 0.0164080161 0.0049962964 0.0053611706
##          508          509          514          515          516          517
## 0.0053433744 0.0053552139 0.0034201427 0.0057083468 0.0035142199 0.0034810849
##          518          519          530          531          532          533
## 0.0036036209 0.0049135996 0.0037441869 0.0036336329 0.0031275435 0.0090151410
##          534          535          536          546          547          548
## 0.0038906963 0.0049713007 0.0093655621 0.0046369932 0.0132030304 0.0124091291
##          549          550          551          552          553          554
## 0.0034016740 0.0031780555 0.0033476372 0.0031625205 0.0027946000 0.0028682029
##          562          563          564          565          566          567
## 0.0016941747 0.0017094055 0.0017386313 0.0016552461 0.0017440653 0.0015860882
##          568          569          570          571          572          573
## 0.0015006559 0.0014611457 0.0031847907 0.0031216310 0.0019781670 0.0033741721
##          574          575          576          578          579          580
## 0.0056099087 0.0021513399 0.0016810040 0.0105951127 0.0024089277 0.0023862438
##          581          582          583          584          585          586
## 0.0011832579 0.0011786294 0.0023757267 0.0012375191 0.0022572902 0.0023791478
##          587          588          589          590          591          592
## 0.0024311984 0.0022251624 0.0021818907 0.0020183155 0.0010385590 0.0010771646
##          594          595          596          597          598          599
## 0.0011050432 0.0030067292 0.0012203507 0.0016519661 0.0010925345 0.0015530692
##          600          601          602          603          604          605
## 0.0012515720 0.0019709736 0.0014745133 0.0016754006 0.0128300616 0.0173386095
##          627          628          629          630          631          632
## 0.0032662538 0.0036987308 0.0120696162 0.0041069768 0.0034013972 0.0122642021
##          633          634          635          636          637          638
## 0.0026617066 0.0021400284 0.0015917857 0.0017833808 0.0096578689 0.0023108861
```

```
##          639          640          641          643          644          645
## 0.0028051780 0.0017786552 0.0092987519 0.0043560023 0.0044459704 0.0046017201
##          646          647          648          649          650          675
## 0.0046562199 0.0050242472 0.0049735457 0.0047499093 0.0073342191 0.0058502487
##          676          677          678          679          680          681
## 0.0055563470 0.0061178045 0.0055365968 0.0052546192 0.0067229282 0.0059554944
##          682          683          684          685          686          687
## 0.0062136383 0.0077524832 0.0062498197 0.0102116946 0.0062140404 0.0069165370
##          688          689          755          756          757          758
## 0.0077784294 0.0068758670 0.0033978250 0.0053507913 0.0050161799 0.0051229289
##          759          760          761          762          772          773
## 0.0055763130 0.0056680552 0.0054563883 0.0068215281 0.0100493251 0.0014900619
##          774          775          776          777          778          779
## 0.0018242926 0.0030406087 0.0016086041 0.0016451732 0.0013091359 0.0012326919
##          780          781          782          783          784          785
## 0.0015705650 0.0015430673 0.0016041918 0.0013668768 0.0012915817 0.0013713435
##          786          788          789          790          791          792
## 0.0013229077 0.0027157467 0.0019173228 0.0017118097 0.0016615775 0.0010381857
##          793          794          795          796          797          798
## 0.0016905366 0.0017118260 0.0011054641 0.0010275307 0.0015138012 0.0087440055
##          799          800          801          802          820          821
## 0.0010963370 0.0027133469 0.0091530156 0.0018456715 0.0013674770 0.0010477684
##          822          823          824          825          826          827
## 0.0013571134 0.0089293017 0.0012310882 0.0012324401 0.0018190161 0.0011406136
##          828          829          830          831          832          833
## 0.0010460048 0.0009437249 0.0109827068 0.0014862685 0.0018080587 0.0016345032
##          834          836          855          856          857          858
## 0.0021858484 0.0058174190 0.0044671528 0.0099255471 0.0041546636 0.0041822988
##          859          860          861          862          863          864
## 0.0039973118 0.0042136915 0.0121196305 0.0114414211 0.0110208401 0.0105754144
##          868          869          870          871          872          873
## 0.0042504956 0.0042299664 0.0042611796 0.0042354042 0.0037749715 0.0035258368
##          874          875          876          877          878          884
## 0.0048021350 0.0052740062 0.0042074207 0.0036303434 0.0035924026 0.0031646567
##          885          886          887          888          889          890
## 0.0089134984 0.0089350127 0.0079803483 0.0020699755 0.0034063073 0.0036242023
##          891          900          901          902          903          904
## 0.0048172626 0.0035785300 0.0030212505 0.0029516776 0.0029876913 0.0030366851
##          905          906          907          908          909          910
## 0.0024822226 0.0029761439 0.0023957350 0.0021684161 0.0021357400 0.0018243022
##          911          912          913          914          932          933
## 0.0018379009 0.0017712223 0.0017505821 0.0015091946 0.0112595386 0.0097870316
##          934          935          936          937          938          939
## 0.0093375268 0.0105082102 0.0085542455 0.0081358516 0.0055633906 0.0055943553
##          940          941          942          943          944          945
## 0.0067183932 0.0058058067 0.0047067093 0.0056478954 0.0047060125 0.0067031449
##          946          948          949          950          951          952
## 0.0052516560 0.0018462455 0.0013586211 0.0093363684 0.0019397968 0.0033405377
##          953          954          955          956          957          980
## 0.0014776253 0.0016108035 0.0015458943 0.0035943731 0.0041113162 0.0038828319
##          981          982          983          984          985          986
## 0.0038294873 0.0043340754 0.0050790936 0.0050645396 0.0050985083 0.0195089003
##          987          988          989          990          991          992
## 0.0063157944 0.0040964006 0.0068148147 0.0048981987 0.0069539416 0.0044289170
```

```
##          993          994          996          997          998          999
## 0.0022318373 0.0164517177 0.0083395256 0.0076585753 0.0070869205 0.0070150574
##         1000         1001         1002         1003         1004         1005
## 0.0082995104 0.0081694426 0.0068762014 0.0080524652 0.0079480834 0.0078427506
##         1006         1007         1008         1009         1010         1012
## 0.0068970421 0.0077720863 0.0078453430 0.0078355214 0.0068610590 0.0022400189
##         1013         1014         1015         1016         1017         1018
## 0.0019015006 0.0011221254 0.0018923995 0.0012853714 0.0013317780 0.0014969021
##         1019         1020         1021         1022         1023         1024
## 0.0020485962 0.0023632477 0.0023784223 0.0023226673 0.0081918152 0.0084898027
##         1028         1029         1030         1031         1032         1033
## 0.0061134813 0.0062743988 0.0056647889 0.0059852071 0.0055997314 0.0053754300
##         1034         1035         1036         1037         1038         1039
## 0.0049487816 0.0051007967 0.0049960642 0.0041907345 0.0029999707 0.0039816677
##         1040         1041         1042         1060         1061         1062
## 0.0037399488 0.0114107289 0.0029868747 0.0018636977 0.0016127232 0.0013887255
##         1063         1064         1065         1066         1067         1068
## 0.0017567623 0.0014108859 0.0013949133 0.0017836457 0.0016559305 0.0089396102
##         1069         1076         1077         1078         1079         1080
## 0.0019276865 0.0035965874 0.0022270672 0.0022738228 0.0025981122 0.0025332255
##         1081         1082         1083         1092         1093         1094
## 0.0082338272 0.0026380058 0.0036957463 0.0017139048 0.0017689235 0.0017498542
##         1095         1096         1097         1108         1109         1110
## 0.0017513524 0.0021124797 0.0018141283 0.0018727722 0.0025153107 0.0021853054
##         1111         1112         1113         1114         1115         1116
## 0.0036749562 0.0017418745 0.0018334440 0.0016062288 0.0011196576 0.0016861195
##         1117         1118         1119         1120         1121         1124
## 0.0015558637 0.0009930139 0.0010106322 0.0011065456 0.0079559201 0.0024062909
##         1125         1140         1141         1142         1143         1144
## 0.0022845053 0.0022944798 0.0032123324 0.0036439958 0.0023876119 0.0024209407
##         1145         1146         1147         1148         1149         1150
## 0.0028030548 0.0023362968 0.0016347284 0.0015129768 0.0018723991 0.0018367438
##         1151         1152         1153         1154         1188         1189
## 0.0021057089 0.0020087233 0.0018685631 0.0016332420 0.0049211062 0.0027138161
##         1190         1191         1192         1193         1194         1195
## 0.0027113305 0.0027479977 0.0015512894 0.0027618165 0.0028658985 0.0050389438
##         1196         1197         1198         1204         1205         1206
## 0.0050714190 0.0051377367 0.0053956496 0.0115567223 0.0024182070 0.0038615173
##         1207         1208         1209         1210         1211         1212
## 0.0022712243 0.0037438925 0.0021820637 0.0036558831 0.0036550607 0.0022109686
##         1213         1214         1215         1216         1217         1218
## 0.0021585700 0.0036926548 0.0090489923 0.0086808871 0.0017059505 0.0022972898
##         1236         1237         1238         1239         1240         1241
## 0.0050328097 0.0096346952 0.0094751416 0.0089511849 0.0019439404 0.0023557561
##         1242         1243         1244         1245         1246         1252
## 0.0024856228 0.0018524749 0.0028722584 0.0020690307 0.0016155155 0.0071346241
##         1253         1254         1255         1256         1268         1269
## 0.0072018367 0.0070682042 0.0068994834 0.0062167794 0.0039839921 0.0050690261
##         1270         1271         1272         1273         1274         1275
## 0.0050925685 0.0036739554 0.0035564044 0.0034831429 0.0049354894 0.0048370727
##         1276         1277         1278         1279         1280         1281
## 0.0047947272 0.0049231991 0.0071731833 0.0038533236 0.0067630378 0.0044241478
##         1282         1284         1285         1286         1287         1288
## 0.0044128029 0.0047989504 0.0050730165 0.0062592739 0.0061848502 0.0063237170
```

```
##         1289         1290         1291         1292         1293         1294
## 0.0051805790 0.0058703256 0.0045485959 0.0057770015 0.0057029271 0.0055942989
##         1295         1296         1297         1298         1300         1301
## 0.0044736215 0.0051341121 0.0044978620 0.0046079055 0.0014252174 0.0012780864
##         1302         1303         1304         1305         1306         1307
## 0.0014290310 0.0013631890 0.0014353534 0.0106507978 0.0013588623 0.0014392376
##         1308         1309         1310         1311         1332         1333
## 0.0018237893 0.0016142338 0.0019336884 0.0017059446 0.0019179268 0.0018916107
##         1334         1335         1336         1337         1338         1339
## 0.0022478264 0.0024754956 0.0020407999 0.0036988111 0.0027348894 0.0023345730
##         1340         1341         1342         1343         1344         1345
## 0.0027056768 0.0027033068 0.0034014249 0.0029663556 0.0036712981 0.0041603986
##         1346         1348         1349         1350         1351         1352
## 0.0038114187 0.0034483500 0.0028480686 0.0032026616 0.0024455199 0.0029764335
##         1353         1354         1355         1356         1357         1358
## 0.0027490371 0.0040660219 0.0034651786 0.0026893726 0.0018508949 0.0018996880
##         1359         1360         1361         1362         1364         1365
## 0.0021571250 0.0021856494 0.0021606498 0.0020015328 0.0010831454 0.0022709324
##         1366         1367         1368         1369         1370         1371
## 0.0022780303 0.0024590138 0.0079108687 0.0013893775 0.0023716504 0.0012328823
##         1372         1373         1374         1375         1376         1380
## 0.0023690323 0.0078569426 0.0016281477 0.0018580394 0.0019327636 0.0036450189
##         1381         1382         1383         1384         1385         1386
## 0.0033674415 0.0034494885 0.0036073547 0.0036992385 0.0127977134 0.0116429610
##         1387         1388         1389         1390         1391         1392
## 0.0177820585 0.0037265879 0.0197368742 0.0218495152 0.0187210408 0.0184879593
##         1393         1394         1444         1445         1446         1447
## 0.0155603664 0.0203864998 0.0046375049 0.0048989579 0.0047885891 0.0058353870
##         1448         1449         1450         1451         1452         1453
## 0.0046088979 0.0045600010 0.0045572641 0.0057151316 0.0045129049 0.0045866882
##         1454         1455         1456         1457         1458         1460
## 0.0044714008 0.0045743295 0.0048445639 0.0050573597 0.0053463287 0.0015938979
##         1461         1462         1463         1464         1465         1466
## 0.0016358910 0.0016591984 0.0017904706 0.0017457729 0.0017627813 0.0023913987
##         1467         1468         1469         1470         1471         1472
## 0.0025415323 0.0030858673 0.0235416445 0.0258980911 0.0284888784 0.0324633535
##         1473         1474         1476         1477         1478         1479
## 0.0376217040 0.0307301009 0.0083118751 0.0156731326 0.0070857686 0.0093621785
##         1480         1481         1482         1483         1484         1485
## 0.0035718078 0.0049532773 0.0028049701 0.0024495613 0.0017178270 0.0015760801
##         1486         1487         1492         1493         1494         1495
## 0.0016825874 0.0082060936 0.0033227981 0.0036339624 0.0084048200 0.0085002964
##         1496         1497         1498         1524         1525         1526
## 0.0105834350 0.0248644083 0.0103837035 0.0046549821 0.0046017318 0.0046775241
##         1527         1528         1529         1530         1531         1532
## 0.0049284616 0.0048098829 0.0046349332 0.0047589275 0.0048636649 0.0050072901
##         1533         1534         1535         1536         1537         1538
## 0.0049598855 0.0155196624 0.0045861364 0.0046027021 0.0047095621 0.0047341130
##         1540         1541         1542         1543         1544         1545
## 0.0060164714 0.0068834297 0.0068859725 0.0060241029 0.0070474375 0.0067580898
##         1546         1547         1548         1549         1550         1551
## 0.0074611911 0.0063762566 0.0065664938 0.0065392242 0.0074285227 0.0070959154
##         1552         1553         1554         1556         1557         1558
## 0.0064785206 0.0062925499 0.0088137421 0.0014094326 0.0018625586 0.0020273747
```

```
##         1559         1560         1561         1562         1563         1564
## 0.0018367459 0.0078429724 0.0012383641 0.0019196506 0.0020440705 0.0014815758
##         1565         1566         1567         1568         1572         1573
## 0.0079474549 0.0015357280 0.0022238236 0.0023715496 0.0079261368 0.0027547350
##         1574         1575         1576         1577         1578         1579
## 0.0129660620 0.0103515975 0.0023723918 0.0027992304 0.0032856896 0.0040075400
##         1580         1581         1582         1583         1584         1588
## 0.0049423622 0.0032045265 0.0030086315 0.0028711381 0.0020143466 0.0022494003
##         1589         1590         1591         1592         1593         1594
## 0.0021689284 0.0021624159 0.0029241287 0.0028282617 0.0020717949 0.0021503848
##         1595         1596         1597         1598         1599         1600
## 0.0027999877 0.0026066079 0.0027335373 0.0018342734 0.0018954704 0.0026793373
##         1601         1602         1604         1605         1606         1607
## 0.0020925703 0.0022458804 0.0245705724 0.0109351491 0.0073862441 0.0065667512
##         1608         1609         1610         1611         1612         1613
## 0.0065856628 0.0108088167 0.0075618389 0.0061573261 0.0062277244 0.0077716842
##         1614         1615         1616         1617         1618         1620
## 0.0062371489 0.0096508369 0.0064015880 0.0064054512 0.0068158930 0.0024952294
##         1621         1622         1623         1624         1625         1626
## 0.0083418279 0.0035950010 0.0021968088 0.0026226897 0.0025358089 0.0035978298
##         1627         1628         1629         1630         1631         1636
## 0.0029547389 0.0030461405 0.0035805419 0.0085508312 0.0038297975 0.0064817698
##         1637         1638         1639         1640         1641         1642
## 0.0066300648 0.0067832817 0.0056130091 0.0060725754 0.0054203388 0.0061028300
##         1643         1644         1645         1646         1647         1653
## 0.0061048319 0.0075828139 0.0056600164 0.0059532589 0.0054980625 0.0029675519
##         1654         1655         1656         1657         1658         1659
## 0.0083887275 0.0085182835 0.0024455054 0.0032267309 0.0028777835 0.0027706296
##         1660         1661         1662         1669         1670         1671
## 0.0024348237 0.0027963928 0.0036259841 0.0026510396 0.0023450512 0.0020493188
##         1672         1673         1674         1675         1676         1677
## 0.0021010804 0.0052532557 0.0017099082 0.0017277917 0.0020573044 0.0016620873
##         1678         1679         1680         1681         1682         1683
## 0.0014936663 0.0031618122 0.0019647487 0.0016624619 0.0014217746 0.0013294847
##         1685         1686         1687         1688         1689         1690
## 0.0012992698 0.0031794688 0.0015630966 0.0018546055 0.0032929733 0.0019339372
##         1691         1692         1693         1694         1695         1696
## 0.0020097333 0.0033363699 0.0015069686 0.0021726237 0.0021132565 0.0015175741
##         1697         1698         1699         1718         1719         1720
## 0.0016543244 0.0019597294 0.0021491425 0.0026737454 0.0027348935 0.0027991134
##         1721         1722         1723         1724         1725         1726
## 0.0026493679 0.0022047120 0.0016251177 0.0013301013 0.0013601524 0.0014906052
##         1727         1728         1729         1730         1731         1732
## 0.0012448693 0.0013758361 0.0016193006 0.0017896704 0.0020498055 0.0023691564
##         1734         1735         1736         1737         1738         1739
## 0.0028259069 0.0028129344 0.0041299372 0.0041204031 0.0021523208 0.0018425291
##         1740         1741         1742         1750         1751         1752
## 0.0016673195 0.0014007643 0.0109812909 0.0012587687 0.0021618168 0.0022079129
##         1753         1754         1755         1756         1757         1758
## 0.0022239303 0.0015704541 0.0024878877 0.0025589962 0.0024570252 0.0017777312
##         1759         1760         1761         1762         1763         1764
## 0.0027520505 0.0019133934 0.0025190214 0.0029125714 0.0030643421 0.0034776368
##         1766         1767         1768         1769         1770         1771
## 0.0026404889 0.0024123844 0.0016709986 0.0018312541 0.0017569369 0.0018252114
```

```
##         1772         1773         1774         1775         1776         1777
## 0.0026362475 0.0027725871 0.0029767781 0.0037588357 0.0028478413 0.0034823708
##         1778         1779         1782         1783         1784         1785
## 0.0037550147 0.0037562661 0.0032494596 0.0029908004 0.0023060817 0.0083474676
##         1786         1787         1788         1789         1790         1791
## 0.0081559305 0.0093513200 0.0034597790 0.0034796828 0.0034356313 0.0035952366
##         1792         1793         1798         1799         1800         1801
## 0.0030160860 0.0036571538 0.0023084720 0.0019348265 0.0015951879 0.0020855994
##         1802         1815         1816         1817         1818         1819
## 0.0014209789 0.0021511741 0.0012980305 0.0089139297 0.0021609721 0.0009837367
##         1820         1821         1822         1823         1824         1825
## 0.0013414564 0.0019195463 0.0018906345 0.0015259040 0.0012855373 0.0075373736
##         1826         1831         1832         1833         1834         1863
## 0.0013648711 0.0090616505 0.0090300795 0.0092033743 0.0073463195 0.0031965925
##         1864         1865         1866         1867         1868         1869
## 0.0024461516 0.0020598600 0.0018357410 0.0015125033 0.0015850071 0.0013402710
##         1870         1871         1872         1873         1874         1875
## 0.0011939529 0.0009630562 0.0010936204 0.0090092782 0.0008881183 0.0010995395
##         1876         1877         1879         1880         1881         1882
## 0.0035375151 0.0011848398 0.0036863319 0.0038975308 0.0038394933 0.0093684664
##         1883         1884         1895         1896         1897         1898
## 0.0042311929 0.0045300109 0.0024181961 0.0030861090 0.0047574866 0.0029269752
##         1899         1900         1901         1902         1903         1904
## 0.0038468003 0.0019803983 0.0081171111 0.0024524237 0.0031299268 0.0043395464
##         1944         1945         1946         1947         1948         1949
## 0.0044923291 0.0044944812 0.0044617308 0.0044412783 0.0027522418 0.0088954244
##         1950         1951         1952         1953         1954         1955
## 0.0090481680 0.0034572558 0.0035626255 0.0037958735 0.0056250680 0.0035712540
##         1961         1962         1963         1964         1965         1966
## 0.0110409992 0.0029979062 0.0017593364 0.0016672020 0.0025029574 0.0017623188
##         1967         1968         1969         1970         1971         1972
## 0.0014736734 0.0013369688 0.0015670206 0.0014938848 0.0026055220 0.0015659946
##         1973         1974         1977         1978         1979         1980
## 0.0022351070 0.0016869440 0.0016608218 0.0077726445 0.0012290440 0.0014374320
##         1981         1982         1983         1984         1985         1986
## 0.0014072194 0.0016632703 0.0017007756 0.0018336726 0.0018325268 0.0022051713
##         1987         1988         1989         1990         1991         1993
## 0.0037668478 0.0033526895 0.0036905719 0.0033707809 0.0034313957 0.0039204799
##         1994         1995         1996         1997         1998         1999
## 0.0098115338 0.0021160195 0.0031816699 0.0022869884 0.0027856295 0.0011608108
##         2000         2001         2002         2003         2004         2009
## 0.0012784310 0.0013737545 0.0012950528 0.0015627957 0.0014904599 0.0015119081
##         2010         2011         2012         2013         2014         2015
## 0.0017392408 0.0014760645 0.0022909275 0.0021637853 0.0022207857 0.0014263433
##         2016         2017         2018         2019         2020         2025
## 0.0022636439 0.0022530863 0.0018917438 0.0020069266 0.0023242134 0.0017310681
##         2026         2027         2028         2029         2030         2031
## 0.0015382588 0.0028087671 0.0016638978 0.0027488600 0.0015083715 0.0016285559
##         2032         2033         2034         2035         2036         2037
## 0.0016240261 0.0016000841 0.0095268185 0.0027943450 0.0016349229 0.0015080149
##         2038         2039         2041         2042         2043         2044
## 0.0027489033 0.0026985357 0.0046470141 0.0044740298 0.0043479045 0.0043202168
##         2045         2046         2047         2048         2049         2050
## 0.0043384926 0.0043083195 0.0051457827 0.0046046970 0.0053257170 0.0053636361
```

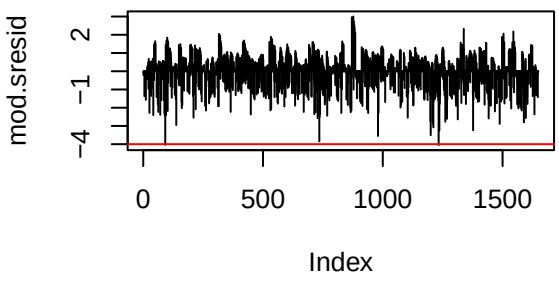
```
##         2051         2052         2053         2054         2055         2057
## 0.0053363883 0.0045709415 0.0044945697 0.0047025419 0.0056071733 0.0066697489
##         2058         2059         2060         2061         2062         2063
## 0.0051387425 0.0053473322 0.0071824415 0.0084887557 0.0066642448 0.0055118659
##         2064         2065         2066         2067         2068         2069
## 0.0052278497 0.0052964407 0.0070500613 0.0054839767 0.0051543916 0.0048447588
##         2070         2071         2121         2122         2123         2124
## 0.0047903724 0.0048191658 0.0047029471 0.0051650439 0.0060701402 0.0047692840
##         2125         2126         2127         2128         2129         2130
## 0.0046674541 0.0046661925 0.0048102533 0.0051032433 0.0052019669 0.0059352924
##         2131         2132         2133         2134         2135         2137
## 0.0063522260 0.0067553069 0.0071207063 0.0075776033 0.0082418693 0.0046108454
##         2138         2139         2140         2141         2142         2143
## 0.0029531118 0.0025000425 0.0023198062 0.0037463680 0.0039864178 0.0022321989
##         2144         2145         2146         2147         2148         2149
## 0.0016767281 0.0022587763 0.0036789490 0.0015846872 0.0034169145 0.0013225150
##         2150         2153         2154         2155         2156         2157
## 0.0019373987 0.0023859889 0.0019180412 0.0020571187 0.0021339873 0.0021343917
##         2158         2159         2160         2161         2162         2163
## 0.0022681629 0.0022357244 0.0030431209 0.0037966332 0.0029280534 0.0027586286
##         2164         2165         2202         2203         2204         2205
## 0.0030872928 0.0028645489 0.0034714016 0.0030961733 0.0021220467 0.0099914702
##         2206         2207         2208         2209         2210         2211
## 0.0035175739 0.0035655026 0.0028685782 0.0031291909 0.0058331333 0.0026445228
##         2212         2213         2214         2215         2216         2219
## 0.0060860611 0.0013122064 0.0012048333 0.0011731224 0.0023739502 0.0020479099
##         2220         2221         2222         2223         2224         2225
## 0.0048084171 0.0024363745 0.0046126582 0.0016731347 0.0029532339 0.0017585280
##         2226         2227         2228         2229         2230         2251
## 0.0030567649 0.0022008135 0.0039686781 0.0050624745 0.0077823730 0.0020108918
##         2252         2253         2254         2255         2256         2257
## 0.0022613910 0.0018873089 0.0040046500 0.0023932888 0.0022106468 0.0025449736
##         2258         2259         2260         2261         2267         2268
## 0.0034127422 0.0032752476 0.0031505491 0.0030358367 0.0030216050 0.0032534461
##         2269         2270         2271         2272         2273         2274
## 0.0037928218 0.0035136968 0.0027139887 0.0041681988 0.0025577781 0.0027880871
##         2275         2276         2277         2283         2284         2285
## 0.0029849501 0.0022221714 0.0021948226 0.0027573707 0.0026420422 0.0035518212
##         2286         2287         2288         2289         2290         2291
## 0.0026222330 0.0038876895 0.0028190928 0.0028207445 0.0039867606 0.0060768192
##         2292         2293         2294         2295         2296         2297
## 0.0024466766 0.0023253868 0.0022486966 0.0023543438 0.0036073477 0.0198548937
##         2299         2300         2301         2302         2303         2304
## 0.0103062417 0.0095764851 0.0085281814 0.0117956276 0.0027682013 0.0172141247
##         2305         2306         2363         2364         2365         2366
## 0.0028902542 0.0030275610 0.0022738662 0.0019102531 0.0019560248 0.0019481533
##         2367         2368         2369         2370         2371         2372
## 0.0027416983 0.0032009805 0.0024675318 0.0026026082 0.0026039953 0.0084592563
##         2373         2374         2375         2376         2377         2395
## 0.0021405260 0.0020444328 0.0025257576 0.0030970233 0.0036118859 0.0034859288
##         2396         2397         2398         2399         2400         2401
## 0.0035001093 0.0026805295 0.0034272348 0.0021421968 0.0019332705 0.0026125524
##         2402         2403         2404         2405         2406         2407
## 0.0024868596 0.0014160551 0.0013566515 0.0036625267 0.0107199840 0.0113534210
```

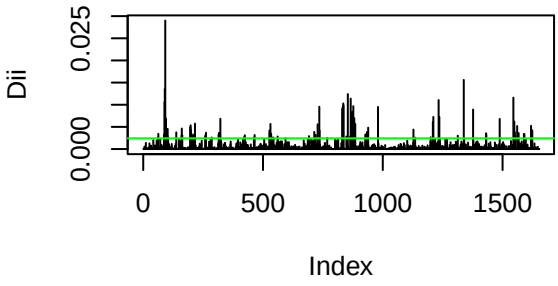
```
##         2408         2409         2427         2428         2429         2430
## 0.0030784563 0.0034149817 0.0059231091 0.0054986030 0.0055723361 0.0064815734
##         2431         2432         2433         2434         2435         2436
## 0.0063225388 0.0062508030 0.0046444563 0.0044298975 0.0053312351 0.0052634506
##         2437         2438         2439         2440         2441         2443
## 0.0054125360 0.0052427595 0.0051464027 0.0042365377 0.0042890158 0.0051972116
##         2444         2445         2446         2447         2448         2449
## 0.0051207977 0.0053121309 0.0053021897 0.0052659711 0.0033264253 0.0032992823
##         2450         2451         2452         2453         2454         2475
## 0.0031541427 0.0047600478 0.0028429436 0.0028610044 0.0048910969 0.0011745076
##         2476         2477         2478         2479         2480         2481
## 0.0018098490 0.0017449303 0.0010593185 0.0019403439 0.0017960063 0.0011289853
##         2482         2483         2484         2491         2492         2493
## 0.0033553205 0.0034653934 0.0013078779 0.0031513136 0.0036020030 0.0021914738
##         2494         2495         2496         2497         2498         2499
## 0.0019175192 0.0021653855 0.0022270775 0.0017824970 0.0013667070 0.0017060803
##         2500         2501         2502         2503         2504         2505
## 0.0017800853 0.0027451420 0.0017734273 0.0049223387 0.0017636201 0.0017336629
##         2507         2508         2509         2510         2546         2547
## 0.0100430706 0.0104712015 0.0101548090 0.0097054735 0.0013008127 0.0018344302
##         2548         2549         2550         2551         2552         2553
## 0.0017911222 0.0012455416 0.0017870593 0.0016199794 0.0017994965 0.0013710648
##         2555         2556         2557         2558         2559         2560
## 0.0015362334 0.0012630549 0.0012010076 0.0015480714 0.0011298543 0.0013470168
##         2561         2562         2563         2564         2565         2566
## 0.0009809512 0.0011723527 0.0030186370 0.0011380157 0.0011616867 0.0014023259
##         2567         2571         2572         2573         2574         2575
## 0.0015165776 0.0033485756 0.0022209199 0.0033557941 0.0017803974 0.0018131207
##         2576         2577         2578         2579         2580         2581
## 0.0030835589 0.0019745193 0.0030684065 0.0030751167 0.0019978156 0.0017787658
##         2582         2583         2584         2585         2603         2604
## 0.0030217629 0.0019119146 0.0031047425 0.0021113194 0.0019414112 0.0018973193
##         2605         2606         2607         2608         2609         2619
## 0.0024041687 0.0023655658 0.0025897670 0.0033152507 0.0033799958 0.0019834950
##         2620         2621         2622         2623         2624         2625
## 0.0017377807 0.0021220639 0.0018887858 0.0014444095 0.0013609265 0.0077752621
##         2635         2636         2637         2638         2639         2640
## 0.0032313353 0.0032799355 0.0036796114 0.0035503908 0.0035848975 0.0056943801
##         2641         2642         2643         2644         2645         2646
## 0.0083946166 0.0033378946 0.0035493231 0.0147701823 0.0084889512 0.0016427642
##         2647         2648         2649         2651         2652         2653
## 0.0016656563 0.0014825148 0.0032578039 0.0017431503 0.0016819878 0.0016724679
##         2654         2655         2656         2657         2658         2659
## 0.0017145295 0.0034021543 0.0098141467 0.0019487479 0.0117856080 0.0021614233
##         2660         2661         2662         2663         2667         2668
## 0.0016415632 0.0019603973 0.0019450028 0.0016671342 0.0020121637 0.0020454409
##         2669         2670         2671         2672         2673         2674
## 0.0019892625 0.0019177925 0.0018083620 0.0018716519 0.0021073664 0.0021340932
##         2675         2676         2677         2678         2679         2680
## 0.0018323971 0.0019257765 0.0029012065 0.0018120625 0.0017502074 0.0012949120
##         2681         2683         2684         2685         2686         2687
## 0.0015992956 0.0019508482 0.0035535557 0.0034652036 0.0019177476 0.0027924640
##         2688         2689         2690         2691         2692         2693
## 0.0028038509 0.0017280433 0.0026937651 0.0087383209 0.0086717097 0.0010145164
```

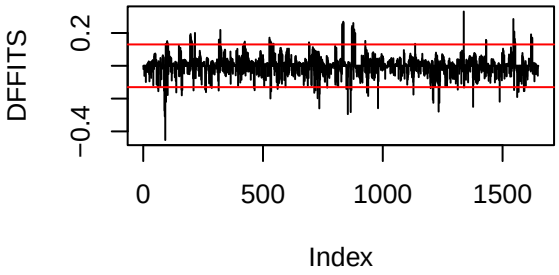
```
##         2694         2695         2696         2697         2699         2700
## 0.0012734734 0.0012655724 0.0025188941 0.0015352797 0.0026929787 0.0028199950
##         2701         2702         2703         2704         2705         2706
## 0.0027857046 0.0026696337 0.0167858153 0.0181214869 0.0163349830 0.0159945855
##         2707         2708         2709         2710         2711         2716
## 0.0163891411 0.0157603527 0.0151493584 0.0143373223 0.0174838926 0.0024240719
##         2717         2718         2719         2720         2721         2722
## 0.0025463705 0.0016532174 0.0041842053 0.0084644124 0.0031516213 0.0040583357
##         2723         2724         2725         2726         2727         2728
## 0.0109400375 0.0046763661 0.0040563764 0.0046982124 0.0028860157 0.0029006127
##         2732         2733         2734         2735         2736         2737
## 0.0064826734 0.0030186762 0.0028532154 0.0046304507 0.0044656602 0.0032329999
##         2738         2739         2740         2741         2742         2743
## 0.0021115280 0.0021369559 0.0023384859 0.0018233370 0.0020202449 0.0020575877
##         2744         2745         2746         2812         2813         2814
## 0.0021526914 0.0025789624 0.0026413481 0.0034349231 0.0053813381 0.0035585250
##         2815         2816         2817         2818         2819         2820
## 0.0034243529 0.0036092154 0.0036044198 0.0032703716 0.0030235021 0.0069379765
##         2821         2822         2823         2824         2825         2826
## 0.0075378247 0.0083927632 0.0023431222 0.0020762211 0.0016714124 0.0018073826
##         2828         2829         2830         2831         2832         2833
## 0.0022094263 0.0022357635 0.0013704137 0.0013620798 0.0014110073 0.0013373547
##         2834         2835         2836         2837         2838         2839
## 0.0021680781 0.0021761154 0.0010608082 0.0023592345 0.0013320015 0.0013755316
##         2840         2844         2845         2846         2847         2848
## 0.0014166435 0.0025573572 0.0017382983 0.0018049549 0.0017695079 0.0015307446
##         2849         2850         2851         2852         2853         2854
## 0.0028701206 0.0029429962 0.0017440067 0.0016779424 0.0173700632 0.0158656381
##         2855         2856         2857         2858         2908         2909
## 0.0143804708 0.0142498401 0.0151771806 0.0144303770 0.0011597390 0.0012530636
##         2910         2911         2912         2913         2914         2915
## 0.0091041826 0.0017782548 0.0089214613 0.0019153737 0.0078932068 0.0017096905
##         2916         2917         2924         2925         2926         2927
## 0.0015960782 0.0014922078 0.0018943336 0.0017526211 0.0017274159 0.0021740955
##         2928         2929         2930         2931         2932         2933
## 0.0015756045 0.0015148282 0.0019691708 0.0016488090 0.0020511348 0.0020452881
##         2934         2935         2936         2937         2938
## 0.0023613550 0.0081923717 0.0018060415 0.0018555355 0.0020259156

##    1   12  105  114  115  116  117  118  119  121  122  123  124  125  126  127
##    1   12   72   80   81   82   83   84   85   87   88   89   90   91   92   93
##  135  154  158  205  233  294  295  296  297  298  299  300  301  302  303  304
##   99  117  121  133  141  196  197  198  199  200  201  202  203  204  205  206
##  326  327  331  332  426  453  503  505  533  536  547  548  578  604  605  629
##  211  212  216  217  280  286  320  322  336  339  341  342  364  389  390  393
##  632  637  641  685  772  798  801  823  830  856  861  862  863  864  885  886
##  396  401  405  424  437  462  465  470  477  484  489  490  491  492  505  506
##  932  933  934  935  936  950  986  994 1041 1068 1204 1215 1216 1237 1238 1239
##  527  528  529  530  531  544  558  566  608  618  676  687  688  692  693  694
## 1305 1385 1386 1387 1389 1390 1391 1392 1393 1394 1469 1470 1471 1472 1473 1474
##  742  797  798  799  801  802  803  804  805  806  831  832  833  834  835  836
## 1477 1479 1495 1496 1497 1498 1534 1554 1574 1575 1604 1605 1609 1615 1630 1655
##  838  840  852  853  854  855  866  885  901  902  927  928  932  938  952  968
## 1742 1787 1817 1831 1832 1833 1873 1882 1949 1950 1961 1994 2034 2205 2297 2299
```

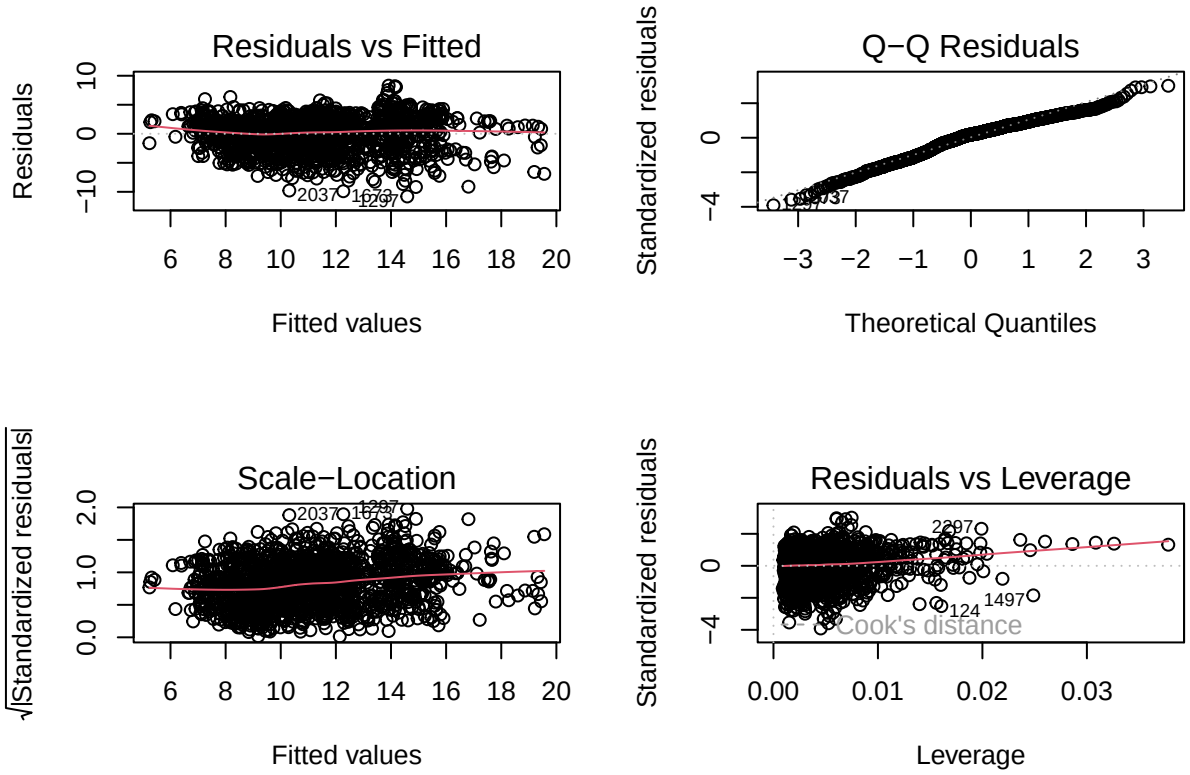
```
## 1029 1064 1078 1088 1089 1090 1102 1110 1128 1129 1135 1165 1197 1278 1338 1339
## 2300 2301 2302 2304 2406 2407 2507 2508 2509 2510 2644 2656 2658 2691 2692 2703
## 1340 1341 1342 1344 1373 1374 1429 1430 1431 1432 1492 1503 1505 1534 1535 1545
## 2704 2705 2706 2707 2708 2709 2710 2711 2723 2853 2854 2855 2856 2857 2858 2910
## 1546 1547 1548 1549 1550 1551 1552 1553 1561 1619 1620 1621 1622 1623 1624 1627
## 2912
## 1629

##  126 2121
##   92 1233

##   91   93  121  123  124  126  130  131  132  133  134  135  136  137  138  140
##   61   63   87   89   90   92   94   95   96   97   98   99  100  101  102  104
##  230  253  254  256  294  296  297  298  299  301  302  304  325  331  397  398
##  138  160  161  163  196  198  199  200  201  203  204  206  210  216  259  260
##  400  453  498  499  500  502  504  505  682  683  685  798  801  932  933  936
##  262  286  315  316  317  319  321  322  421  422  424  462  465  527  528  531
##  937  938  939  940  941  950  989 1024 1237 1238 1275 1281 1290 1297 1298 1352
##  532  533  534  535  536  544  561  594  692  693  714  720  728  735  736  768
## 1469 1470 1471 1472 1473 1474 1487 1497 1532 1534 1535 1537 1540 1541 1543 1546
##  831  832  833  834  835  836  848  854  864  866  867  869  871  872  874  877
## 1548 1550 1551 1553 1554 1604 1611 1616 1673 1949 1961 2037 2047 2049 2121 2124
##  879  881  882  884  885  927  934  939  980 1128 1135 1200 1209 1211 1233 1236
## 2267 2297 2299 2427 2509 2510 2640 2703 2706 2707 2709 2710 2711 2723 2732 2819
## 1313 1338 1339 1377 1431 1432 1488 1545 1548 1549 1551 1552 1553 1561 1567 1589
## 2821 2853 2854 2856 2857 2858
## 1591 1619 1620 1622 1623 1624

##   91   93  121  123  124  126  130  131  132  133  134  135  136  137  138  140
##   61   63   87   89   90   92   94   95   96   97   98   99  100  101  102  104
##  230  253  254  256  294  296  297  298  299  301  302  304  325  331  397  398
##  138  160  161  163  196  198  199  200  201  203  204  206  210  216  259  260
##  400  453  498  499  500  502  504  505  682  683  685  798  801  932  933  936
##  262  286  315  316  317  319  321  322  421  422  424  462  465  527  528  531
##  937  938  939  940  941  950  989 1024 1237 1238 1275 1281 1290 1297 1298 1352
##  532  533  534  535  536  544  561  594  692  693  714  720  728  735  736  768
## 1469 1470 1471 1472 1473 1474 1487 1497 1532 1534 1535 1537 1540 1541 1543 1546
##  831  832  833  834  835  836  848  854  864  866  867  869  871  872  874  877
## 1548 1550 1551 1553 1554 1604 1611 1616 1673 1949 1961 2037 2047 2049 2121 2124
##  879  881  882  884  885  927  934  939  980 1128 1135 1200 1209 1211 1233 1236
## 2267 2297 2299 2427 2509 2510 2640 2703 2706 2707 2709 2710 2711 2723 2732 2819
## 1313 1338 1339 1377 1431 1432 1488 1545 1548 1549 1551 1552 1553 1561 1567 1589
## 2821 2853 2854 2856 2857 2858
## 1591 1619 1620 1622 1623 1624

##
## Call:
## lm(formula = bc_GDP ~ Status + I(Total.expenditure^2) + Polio +
##     I(log(Population)) + Income.composition.of.resources + I(Schooling^2),
##     data = clean_data6)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
```

```
## -10.7965  -1.8298   0.4982   1.9687   8.2887
##
## Coefficients:
##                                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)                     6.329789   0.597670  10.591  < 2e-16 ***
## StatusDeveloping               -1.245231   0.234032  -5.321 1.18e-07 ***
## I(Total.expenditure^2)          0.003577   0.002429   1.473    0.141
## Polio                          -0.003347   0.003242  -1.032    0.302
## I(log(Population))             -0.002211   0.025005  -0.088    0.930
## Income.composition.of.resources  4.154936   0.591220   7.028 3.07e-12 ***
## I(Schooling^2)                  0.022231   0.001746  12.733  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.765 on 1640 degrees of freedom
## Multiple R-squared:  0.4343, Adjusted R-squared:  0.4322
## F-statistic: 209.8 on 6 and 1640 DF,  p-value: < 2.2e-16
```









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