Assignment_3_Question_1

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Problem 1.

```
library(faraway)
#Printing out the savings data and checking its structure
savings
```

```
##                 sr pop15 pop75     dpi  ddpi
## Australia    11.43 29.35  2.87 2329.68  2.87
## Austria      12.07 23.32  4.41 1507.99  3.93
## Belgium      13.17 23.80  4.43 2108.47  3.82
## Bolivia       5.75 41.89  1.67  189.13  0.22
## Brazil       12.88 42.19  0.83  728.47  4.56
## Canada        8.79 31.72  2.85 2982.88  2.43
## Chile         0.60 39.74  1.34  662.86  2.67
## China        11.90 44.75  0.67  289.52  6.51
## Colombia      4.98 46.64  1.06  276.65  3.08
## Costa Rica   10.78 47.64  1.14  471.24  2.80
## Denmark      16.85 24.42  3.93 2496.53  3.99
## Ecuador       3.59 46.31  1.19  287.77  2.19
## Finland      11.24 27.84  2.37 1681.25  4.32
## France       12.64 25.06  4.70 2213.82  4.52
## Germany      12.55 23.31  3.35 2457.12  3.44
## Greece       10.67 25.62  3.10  870.85  6.28
## Guatamala     3.01 46.05  0.87  289.71  1.48
## Honduras      7.70 47.32  0.58  232.44  3.19
## Iceland       1.27 34.03  3.08 1900.10  1.12
## India         9.00 41.31  0.96   88.94  1.54
## Ireland      11.34 31.16  4.19 1139.95  2.99
## Italy        14.28 24.52  3.48 1390.00  3.54
## Japan        21.10 27.01  1.91 1257.28  8.21
## Korea         3.98 41.74  0.91  207.68  5.81
## Luxembourg   10.35 21.80  3.73 2449.39  1.57
## Malta        15.48 32.54  2.47  601.05  8.12
## Norway       10.25 25.95  3.67 2231.03  3.62
## Netherlands  14.65 24.71  3.25 1740.70  7.66
## New Zealand  10.67 32.61  3.17 1487.52  1.76
## Nicaragua     7.30 45.04  1.21  325.54  2.48
## Panama        4.44 43.56  1.20  568.56  3.61
## Paraguay      2.02 41.18  1.05  220.56  1.03
## Peru         12.70 44.19  1.28  400.06  0.67
```

```
## Philippines    12.78 46.26  1.12  152.01  2.00
## Portugal       12.49 28.96  2.85  579.51  7.48
## South Africa   11.14 31.94  2.28  651.11  2.19
## South Rhodesia 13.30 31.92  1.52  250.96  2.00
## Spain          11.77 27.74  2.87  768.79  4.35
## Sweden          6.86 21.44  4.54 3299.49  3.01
## Switzerland    14.13 23.49  3.73 2630.96  2.70
## Turkey          5.13 43.42  1.08  389.66  2.96
## Tunisia         2.81 46.12  1.21  249.87  1.13
## United Kingdom  7.81 23.27  4.46 1813.93  2.01
## United States   7.56 29.81  3.43 4001.89  2.45
## Venezuela       9.22 46.40  0.90  813.39  0.53
## Zambia         18.56 45.25  0.56  138.33  5.14
## Jamaica         7.72 41.12  1.73  380.47 10.23
## Uruguay         9.24 28.13  2.72  766.54  1.88
## Libya           8.89 43.69  2.07  123.58 16.71
## Malaysia        4.71 47.20  0.66  242.69  5.08
```

```
str(savings)
```

```
## 'data.frame':    50 obs. of  5 variables:
##  $ sr   : num  11.43 12.07 13.17 5.75 12.88 ...
##  $ pop15: num  29.4 23.3 23.8 41.9 42.2 ...
##  $ pop75: num  2.87 4.41 4.43 1.67 0.83 2.85 1.34 0.67 1.06 1.14 ...
##  $ dpi  : num  2330 1508 2108 189 728 ...
##  $ ddpi : num  2.87 3.93 3.82 0.22 4.56 2.43 2.67 6.51 3.08 2.8 ...
```

```
#Fitting the linear model with for the predictor variables pop15, pop75, dpi, ddpi
model_1 <- lm(sr ~ pop15 + pop75 + dpi + ddpi, data = savings)
summary(model_1)
```

```
##
## Call:
## lm(formula = sr ~ pop15 + pop75 + dpi + ddpi, data = savings)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -8.2422 -2.6857 -0.2488  2.4280  9.7509
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 28.5660865  7.3545161   3.884 0.000334 ***
## pop15       -0.4611931  0.1446422  -3.189 0.002603 **
## pop75       -1.6914977  1.0835989  -1.561 0.125530
## dpi         -0.0003369  0.0009311  -0.362 0.719173
## ddpi         0.4096949  0.1961971   2.088 0.042471 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.803 on 45 degrees of freedom
## Multiple R-squared:  0.3385, Adjusted R-squared:  0.2797
## F-statistic: 5.756 on 4 and 45 DF,  p-value: 0.0007904
```

```r
#Total sum of squares
sum((savings$sr - mean(savings$sr))^2)
```

```
## [1] 983.6282
```

```r
#Residual sum of squares
sum(model_1$res^2)
```

```
## [1] 650.713
```

```r
#F-test
((983.63 - 650.71) / 4) / (650.706/45)
```

```
## [1] 5.755825
```

```r
#P-value
1 - pf(5.7558,4,45)
```

```
## [1] 0.0007902633
```

```r
#As the p-value is very less and equal to 0.0007902633, we can reject the null hypothesis
#at a significance level of 0.1

#b
#beta(pop15) = beta(pop75) if it is true for a significance level of 0.05;

model_2 <- lm(sr ~ I(pop15 + pop75) + dpi + ddpi, data = savings)
anova(model_2, model_1)
```

```
## Analysis of Variance Table
##
## Model 1: sr ~ I(pop15 + pop75) + dpi + ddpi
## Model 2: sr ~ pop15 + pop75 + dpi + ddpi
##   Res.Df    RSS Df Sum of Sq      F Pr(>F)
## 1     46 673.63
## 2     45 650.71  1    22.915 1.5847 0.2146
```

```r
#b
#beta(pop15) = beta(pop75) if it is true for a significance level of 0.05;

model_2 <- lm(sr ~ I(pop15 + pop75) + dpi + ddpi, data = savings)
anova(model_2, model_1)
```

#The p-values comes out be 0.2146 for the combined model hence we can't reject the null hypothesis #at a significance level of 0.05.