

Assignment 4: Collaborating Together

Introduction to Applied Data Science

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Part 1: Contributing to another student's Github repository

In this assignment, you will create a Github repository, containing this document and the .pdf output, which analyzes a dataset individually using some of the tools we have developed.

This time, make sure to not only put your name and student e-mail in your Rmarkdown header, but also your Github account, as I have done myself.

However, you will also pair up with a class mate and contribute to each others' Github repository. Each student is supposed to contribute to another student's work by writing a short interpretation of 1 or 2 sentences at the designated place (this place is marked with **designated place**) in the other student's assignment.

This interpretation will not be graded, but a Github shows the contributors to a certain repository. This way, we can see whether you have contributed to a repository of a class mate.

Question 1.1: Fill in the **github username** of the class mate to whose repository you have contributed.

[<http://www.github.com/YanzhenRen>]

Part 2: Analyzing various linear models

In this part, we will summarize a dataset and create a couple of customized tables. Then, we will compare a couple of linear models to each other, and see which linear model fits the data the best, and yields the most interesting results.

We will use a dataset called **GrowthSW** from the **AER** package. This is a dataset containing 65 observations on 6 variables and investigates the determinants of economic growth. First, we will try to summarize the data using the **modelsummary** package.

```
library(AER)
data(GrowthSW)
```

One of the variables in the dataset is **revolutions**, the number of revolutions, insurrections and coup d'états in country i from 1965 to 1995.

	treat	Mean	Median	sd	Max	min
growth	NO	2.46	2.29	1.28	6.65	0.42
	YES	1.68	1.92	2.11	7.16	-2.81
rgdp60	NO	5283.32	5393.00	2439.39	9895.00	1374.00
	YES	1988.67	1259.00	1698.18	6823.00	367.00

Question 2.1: Using the function `datasummary`, summarize the mean, median, sd, min, and max of the variables `growth`, and `rgdp60` between two groups: countries with `revolutions` equal to 0, and countries with more than 0 revolutions. Call this variable `treat`. Make sure to also write the resulting data set to memory. Hint: you can check some examples [here](#).

```
library(modelsummary); library(tidyverse)

# write your code here
GrowthSW<- GrowthSW|>
  mutate(treat=if_else(revolutions > 0, "YES","NO"))
datasummary((growth+rgdp60)*treat~(Mean+Median+sd+Max+min),(data=GrowthSW))
```

Designated place: type one or two sentences describing this table of a fellow student below. For example, comment on the mean and median growth of both groups. Then stage, commit and push it to their github repository.

Part 3: Make a table summarizing reessions using `modelsummary` and `kable`

In question 2, we have seen that growth rates differ markedly between countries that experienced at least one revolution/episode of political stability and countries that did not.

Question 3.1: Try to make this more precise this by performing a t-test on the variable `growth` according to the group variable you have created in the previous question.

```
# write t test here
treatment_group <- GrowthSW$growth[GrowthSW$treat=="YES"]
control_group <- GrowthSW$growth[GrowthSW$treat=="NO"]
t_test_result <- t.test (treatment_group,control_group)
print(t_test_result)

##
## Welch Two Sample t-test
##
## data: treatment_group and control_group
## t = -1.8531, df = 61.015, p-value = 0.06871
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -1.62566475 0.06182741
## sample estimates:
## mean of x mean of y
## 1.678066 2.459985
```

Question 3.2: What is the p -value of the test, and what does that mean? Write down your answer below.
 # The p -value represents the significance level of the t-test. In this case, p -value= 0.06871, which is greater

	(1)	(2)	(3)	(4)
(Intercept)	2.460*** (0.400)	2.854*** (0.751)	0.839 (1.045)	-0.050 (0.967)
treatYES	-0.782 (0.491)	-1.028 (0.633)	-0.415 (0.647)	-0.069 (0.589)
rgdp60		0.000 (0.000)	0.000 (0.000)	0.000* (0.000)
tradeshare			2.233* (0.842)	1.813* (0.765)
education				0.564*** (0.144)
Num.Obs.	65	65	65	65
R2	0.039	0.045	0.143	0.318

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

than the significance level alpha, 0.05. Therefore, there is no significantly different in means between groups 'No'(countries no revolution) and groups 'YES'(countries that experienced at least one revolutions).

We can also control for other factors by including them in a linear model, for example:

$$\text{growth}_i = \beta_0 + \beta_1 \cdot \text{treat}_i + \beta_2 \cdot \text{rgdp60}_i + \beta_3 \cdot \text{tradeshare}_i + \beta_4 \cdot \text{education}_i + \epsilon_i$$

Question 3.3: What do you think the purpose of including the variable `rgdp60` is? Look at `?GrowthSW` to find out what the variables mean. #The variable 'rgdp60' means value of GDP per capita in 1960, converted to 1960 US dollars. Economic inflation changes value of dollars overtime, however, converted into the same current value makes observers able to compare GDP in numbers with the same value.

We now want to estimate a stepwise model. Stepwise means that we first estimate a univariate regression $\text{growth}_i = \beta_0 + \beta_1 \cdot \text{treat}_i + \epsilon_i$, and in each subsequent model, we add one control variable.

Question 3.4: Write four models, titled `model1`, `model2`, `model3`, `model4` (using the `lm` function) to memory. Hint: you can also use the `update` function to add variables to an already existing specification.

```
model1 <- lm(growth~treat, data=GrowthSW)
model2 <- lm(growth~treat+rgdp60, data=GrowthSW)
model3 <- lm(growth~treat+rgdp60+tradeshare, data=GrowthSW)
model4 <- lm(growth~treat+rgdp60+tradeshare+education, data=GrowthSW)
```

Now, we put the models in a list, and see what `modelsummary` gives us:

```
list(model1, model2, model3, model4) |>
  modelsummary(stars=T,
# edit this to remove the statistics other than R-squared
# and N
gof_omit='R2 Adj.|AIC|BIC|Log.Lik.|F|RMSE')
```

Question 3.5: Edit the code chunk above to remove many statistics from the table, but keep only the number of observations N , and the R^2 statistic.

Question 3.6: According to this analysis, what is the main driver of economic growth? Why? #The main driver of economic growth is 'education'. Because in model 4, the 'R square' is 0.318. This means 31% variance can be explained by these four independent variables, which is much more greater than 'R square' in model 1 and model 2.

	(1)	(2)	(3)	(4)
(Intercept)	2.460*** (0.400)	2.854*** (0.751)	0.839 (1.045)	-0.050 (0.967)
treatYES	-0.782 (0.491)	-1.028 (0.633)	-0.415 (0.647)	-0.069 (0.589)
rgdp60		0.000 (0.000)	0.000 (0.000)	0.000* (0.000)
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Question 3.7: In the code chunk below, edit the table such that the cells (including standard errors) corresponding to the variable `treat` have a red background and white text. Make sure to load the `kableExtra` library beforehand.

```
library(kableExtra)
table<- list(model1, model2, model3, model4) |>
  modelsummary(stars=T, gof_map = c("nobs", "r.squared"))
table <- table %>%
  row_spec(row =3:4, background = "red", color = 'white')
table
```

Question 3.8: Write a piece of code that exports this table (without the formatting) to a Word document.

```
modelsummary(list(model1,model2,model3,model4),
  gof_map=c("nobs","r.squared"),
  tittle="Regression table",
  output='table_regression.docx')
```

The End