Problem Set 3

Applied Stats/Quant Methods 1

Due: November 20, 2022

Question 1

1. **Run a regression where the outcome variable is `voteshare` and the explanatory variable is `difflog`.**

```
1  Diff_Vote_Reg <- lm(voteshare ~ difflog, data = inc.sub) # fit the model
2
3  summary(Diff_Vote_Reg)
4
5  stargazer(Diff_Vote_Reg, type = "latex", out = "Diff_Vote_Reg.latex",
       title =
6            "Difflog-Voteshare Regression")
```

Table 1: Difflog-Voteshare Regression

	Dependent variable:
	voteshare
difflog	0.042***
	(0.001)
Constant	0.579***
	(0.002)
Observations	3,193
R^2	0.367
Adjusted R^2	0.367
Residual Std. Error	0.079 (df = 3191)
F Statistic	1,852.791*** (df = 1; 3191)
Note:	*p<0.1; **p<0.05; ***p<0.01

2. Make a scatterplot of the two variables and add the regression line.

```
1  ggplot(inc.sub, aes(x = difflog, y = voteshare)) +
2    geom_point() +
3    geom_smooth(method = "lm", color = "red") +      # regression line
4    theme_bw() +
5    labs(title = "Voteshare as a function of Difflog",
6         x = "Difflog",
7         y = "Voteshare")
```

Figure 1: Difflog-Voteshare Regression

Voteshare as a function of Difflog
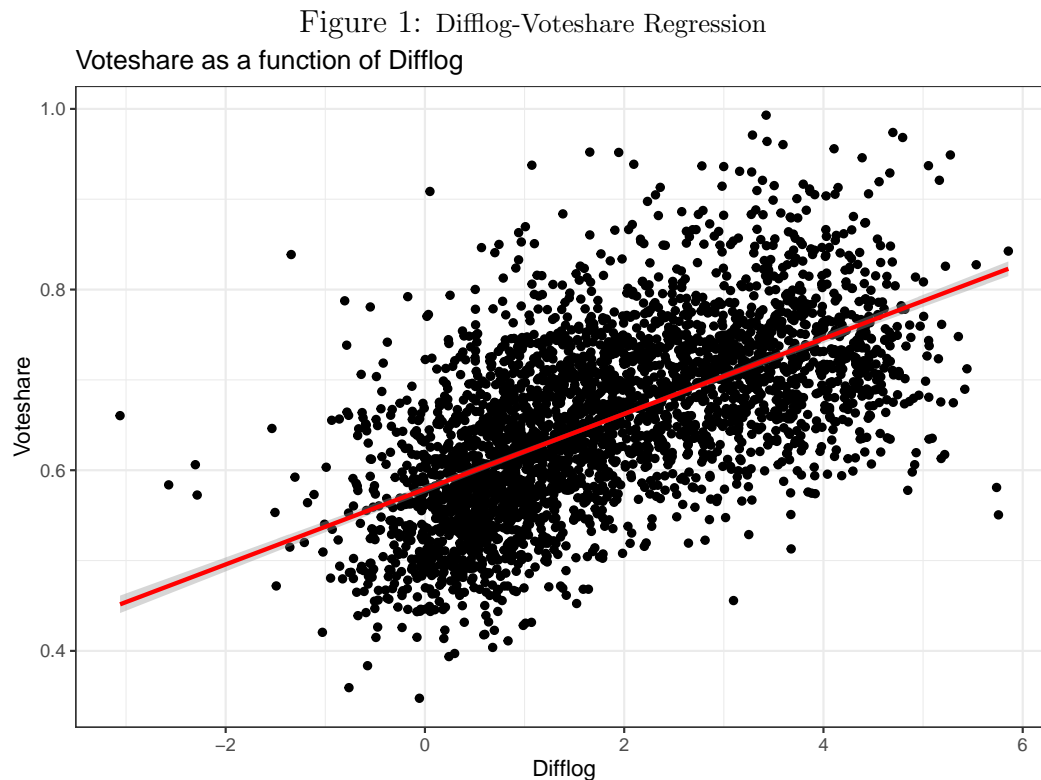
3. Save the residuals of the model in a separate object.

```
1  inc.sub$residuals <- residuals(Diff_Vote_Reg) # Save the residual values
2  Voteshare_res <- inc.sub$residuals
```

4. Write the prediction equation.

The estimated regression line equation can be written as follows:
voteshare = 0.58 + 0.04*difflog

2

Question 2

We are interested in knowing how the difference between incumbent and challenger's spending and the vote share of the presidential candidate of the incumbent's party are related.

1. **Run a regression where the outcome variable is `presvote` and the explanatory variable is `difflog`.**

```
1  Diff_Presvote_Reg <- lm(presvote ~ difflog, data = inc.sub) # fit the
       model
2
3  summary(Diff_Presvote_Reg)
4
5  stargazer(Diff_Presvote_Reg, type = "latex\vspace{.25cm}", out = "Diff_
       Presvote_Reg.latex", title =
6            "Difflog-Presvote Regression")
```

Table 2: Difflog-Presvote Regression

	Dependent variable:
	presvote
difflog	0.024***
	(0.001)
Constant	0.508***
	(0.003)
Observations	3,193
R^2	0.088
Adjusted R^2	0.088
Residual Std. Error	0.110 (df = 3191)
F Statistic	307.715*** (df = 1; 3191)
Note:	*p<0.1; **p<0.05; ***p<0.01

2. **Make a scatterplot of the two variables and add the regression line.**

```
1  ggplot(inc.sub, aes(x = difflog, y = presvote)) +
2    geom_point() +
3    geom_smooth(method = "lm", color = "red") +      # regression line
4    theme_bw() +
5    labs(title = "Presvote as a function of Difflog",
6         x = "Difflog",
7         y = "Presvote")
```

Figure 2: Difflog-Presvote Regression

Presvote as a function of Difflog
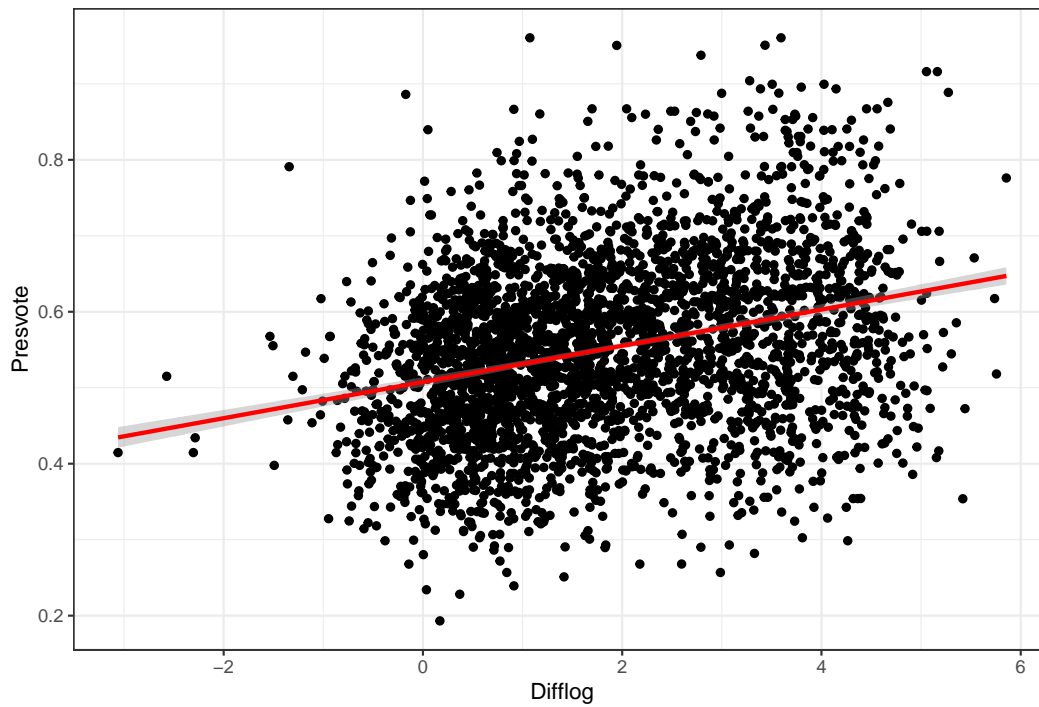
3. **Save the residuals of the model in a separate object.**

```
1 inc.sub$residuals <- residuals(Diff_Presvote_Reg) # Save the residual
     values
2 Presvote_res <- inc.sub$residuals
```

4. **Write the prediction equation.**

The estimated regression line equation can be written as follows:
presvote = 0.51 + 0.02*difflog

4

Question 3

We are interested in knowing how the vote share of the presidential candidate of the incumbent's party is associated with the incumbent's electoral success.

1. **Run a regression where the outcome variable is `voteshare` and the explanatory variable is `presvote`.**

```r
Presvote_Voteshare_Reg <- lm(voteshare ~ presvote, data = inc.sub) # fit
    the model

summary(Presvote_Voteshare_Reg)

stargazer(Presvote_Voteshare_Reg, type = "latex", out = "Presvote_
    Voteshare_Reg.latex", title =
            "Presvote-Voteshare Regression")
```

Table 3: Presvote-Voteshare Regression

	Dependent variable:
	voteshare
presvote	0.388***
	(0.013)
Constant	0.441***
	(0.008)
Observations	3,193
R^2	0.206
Adjusted R^2	0.206
Residual Std. Error	0.088 (df = 3191)
F Statistic	826.950*** (df = 1; 3191)
Note:	*p<0.1; **p<0.05; ***p<0.01

2. **Make a scatterplot of the two variables and add the regression line.**

```r
ggplot(inc.sub, aes(x = presvote, y = voteshare)) +
  geom_point() +
  geom_smooth(method = "lm", color = "red") +      # regression line
  theme_bw() +
  labs(title = "Voteshare as a function of Presvote",
       x = "Presvote",
       y = "Voteshare")
```

Figure 3: Presvote-Voteshare Regression

Voteshare as a function of Presvote
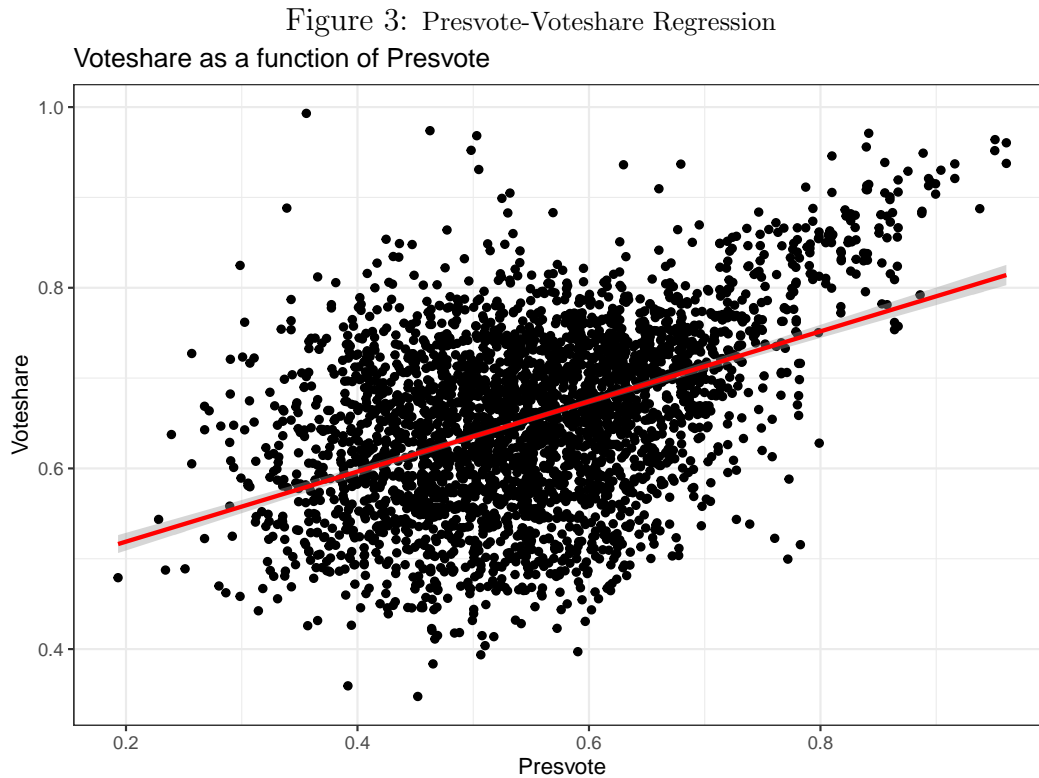
3. **Write the prediction equation.**

The estimated regression line equation can be written as follows:
voteshare = 0.44 + 0.39*presvote

Question 4

The residuals from part (a) tell us how much of the variation in `voteshare` is *not* explained by the difference in spending between incumbent and challenger. The residuals in part (b) tell us how much of the variation in `presvote` is *not* explained by the difference in spending between incumbent and challenger in the district.

1. **Run a regression where the outcome variable is the residuals from Question 1 and the explanatory variable is the residuals from Question 2.**

```
Q1Resid_Q2Resid_Reg <- lm(Voteshare_res ~ Presvote_res, data = inc.sub) #
    fit the model

summary(Q1Resid_Q2Resid_Reg)

stargazer(Q1Resid_Q2Resid_Reg, type = "latex", out = "Q1Resid_Q2Resid_Reg
    .latex", title =
          "Q1 Residuals--Q2 Residuals Regression")
```

Table 4: Q1 Residuals-Q2 Residuals Regression

	Dependent variable:
	Voteshare_res
Presvote_res	0.257***
	(0.012)
Constant	−0.000
	(0.001)
Observations	3,193
R^2	0.130
Adjusted R^2	0.130
Residual Std. Error	0.073 (df = 3191)
F Statistic	476.975*** (df = 1; 3191)
Note:	*p<0.1; **p<0.05; ***p<0.01

2. **Make a scatterplot of the two residuals and add the regression line.**

```
1  ggplot(inc.sub, aes(x = Presvote_res, y = Voteshare_res)) +
2    geom_point() +
3    geom_smooth(method = "lm", color = "red") +      # regression line
4    theme_bw() +
5    labs(title = "Voteshare Residuals as a function of Presvote Residuals",
6         x = "Presvote Residuals",
7         y = "Voteshare Residuals")
```
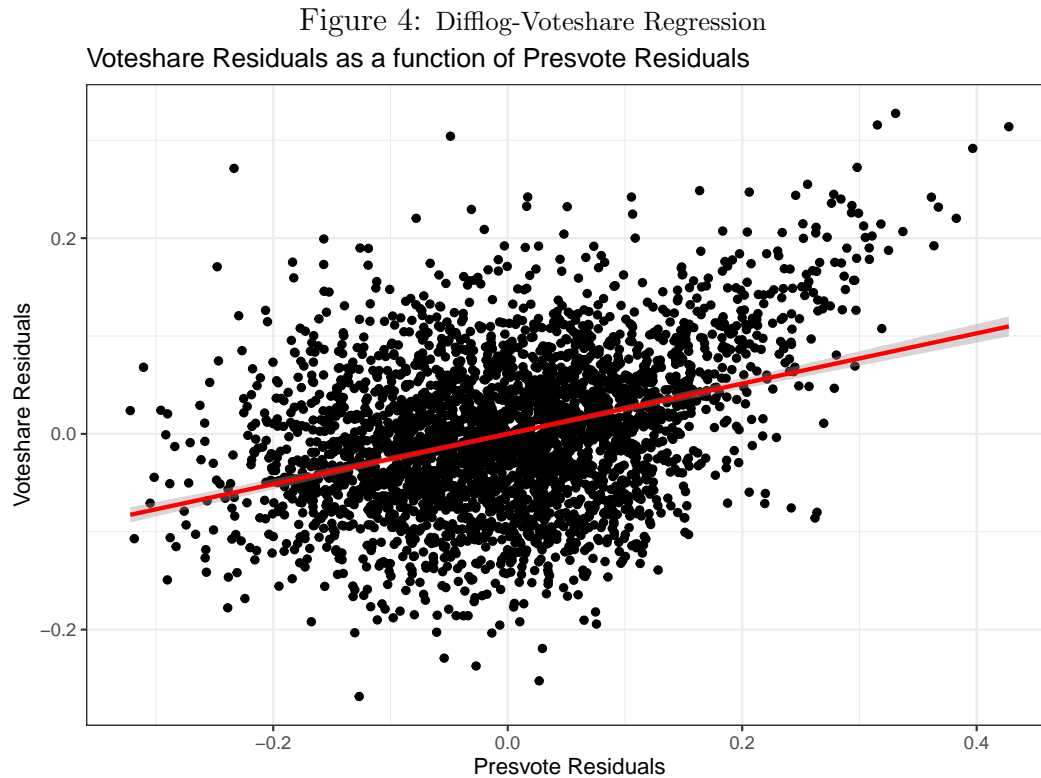
Figure 4: Difflog-Voteshare Regression

Voteshare Residuals as a function of Presvote Residuals

3. **Write the prediction equation.**
   The estimated regression line equation can be written as follows:
   Q1Resid = -4.860e-18 + 2.569e-01*Q2Resid

Question 5

What if the incumbent's vote share is affected by both the president's popularity and the difference in spending between incumbent and challenger?

1. **Run a regression where the outcome variable is the incumbent's `voteshare` and the explanatory variables are `difflog` and `presvote`.**

```
1 Diff_Presvote_Voteshare_Reg <- lm(voteshare ~ difflog + presvote, data =
    inc.sub) # fit the model
2
3 summary(Diff_Presvote_Voteshare_Reg)
4
5 stargazer(Diff_Presvote_Voteshare_Reg, type = "latex", out = "Q5.latex",
    title =
6          "Difflog & Presvote - Voteshare Regression")
```

Table 5: Difflog and Presvote - Voteshare Regression

	Dependent variable:
	voteshare
difflog	0.036***
	(0.001)
presvote	0.257***
	(0.012)
Constant	0.449***
	(0.006)
Observations	3,193
R^2	0.450
Adjusted R^2	0.449
Residual Std. Error	0.073 (df = 3190)
F Statistic	1,302.947*** (df = 2; 3190)
Note:	*p<0.1; **p<0.05; ***p<0.01

2. **Write the prediction equation.**

   The estimated regression line equation can be written as follows:
   voteshare = 0.45 + (0.04*difflog) + (0.26*presvote)

9

3. **What is it in this output that is identical to the output in Question 4? Why do you think this is the case?**

   The Residual Std. Error in the output for this question is identical to the Residual Std. Error in the output for Q4.

   This is because running a regression of the residuals of voteshare $\sim$ difflog against the residuals of presvote $\sim$ difflog as we do in Q4, tells us how much of the unexplained variation in voteshare is influenced by presvote.

   In Q5, we are essentially showing the same thing in a different way, by running a regression of voteshare against difflog AND presvote, we can see how much of the unexplained variance in voteshare $\sim$ difflog is explained by presvote,and this means that the Residual Std. Error will be the same.