hw7

```
library(here)
library(tidyverse)
library(sandwich)
data <- read.table(here("data", "rdcongress.txt"))
# response = dwnom
# forcing variable demvoteshare
```

a

```
data_clean <- data %>%
  select(dwnom, demvoteshare) %>%
  drop_na() %>%
  mutate(demvoteshare_t = demvoteshare - 0.5)
```

b

First fit the models and compute robust variance estiamtes for their parameters

```
lm_lower <- lm(
  dwnom ~ demvoteshare_t,
  data = filter(data_clean, between(demvoteshare_t, -0.02, 0))
  )
lower_vcov <- vcovHC(lm_lower, type="HC")

lm_upper <- lm(
  dwnom ~ demvoteshare_t,
  data = filter(data_clean, between(demvoteshare_t, 0, 0.02))
)
upper_vcov <- vcovHC(lm_upper, type="HC")
```

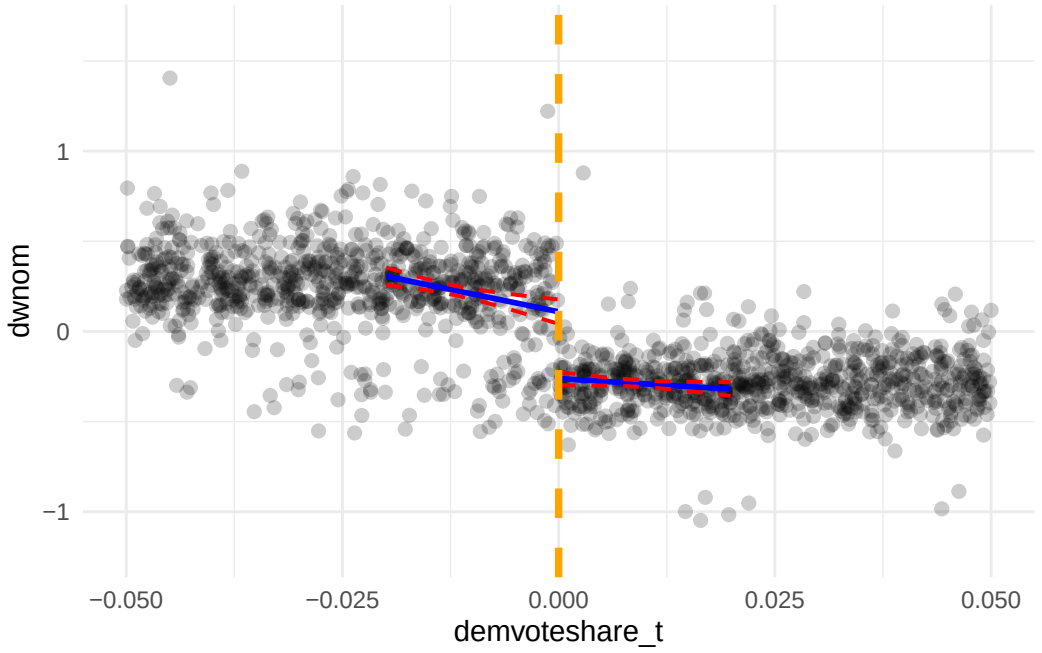
Using the provided formula, compute 95% confidence intervals using robust standard errors for the two regression lines

```
# var(intercept) + x2 var(slope) + 2*x*cov(slope, intercept)

se_lower <- fortify(lm_lower) %>%
  mutate(
    var_l = lower_vcov[1, 1] + demvoteshare_t^2*lower_vcov[2, 2] +
      2*demvoteshare_t*lower_vcov[1, 2],
    se_l = sqrt(var_l)
    ) %>%
  mutate(lower = .fitted - 1.96*se_l,
         upper = .fitted + 1.96*se_l) %>%
  select(demvoteshare_t, upper, lower)

se_upper <- fortify(lm_upper) %>%
  mutate(
    var_u = upper_vcov[1, 1] + demvoteshare_t^2*upper_vcov[2, 2] +
      2*demvoteshare_t*upper_vcov[1, 2],
    se_u = sqrt(var_u)
    ) %>%
  mutate(lower = .fitted - 1.96*se_u,
         upper = .fitted + 1.96*se_u) %>%
  select(demvoteshare_t, upper, lower)
```

Plot the reggression lines, the confidence intervals and the cutoff all on one plot. We'll look at a restricted range of the forcing variable so we can see these things more easily. My substantive interpretation is that we do see a discontinuity in our forcing variable and that lower proportions of democratic vote share are associated with higher values of dwnom while higher proportions of democratic vote share are associated with lower values of dwnom.

```
data_clean %>%
  ggplot(aes(x = demvoteshare_t, y = dwnom)) +
  geom_point(size = 2, alpha = 0.2) +
  geom_line(data = fortify(lm_lower),
            aes(x = demvoteshare_t, y = .fitted),
            size = 1, color = "blue") +
  geom_line(data = se_lower,
            aes(x = demvoteshare_t, y = lower),
            size = 0.7, color = "red", linetype = "dashed") +
  geom_line(data = se_lower,
            aes(x = demvoteshare_t, y = upper),
```

```
            size = 0.7, color = "red", linetype = "dashed") +
  geom_line(data = fortify(lm_upper),
            aes(x = demvoteshare_t, y = .fitted),
            size = 1, color = "blue") +
  geom_line(data = se_upper,
            aes(x = demvoteshare_t, y = lower),
            size = 0.7, color = "red", linetype = "dashed") +
  geom_line(data = se_upper,
            aes(x = demvoteshare_t, y = upper),
            size = 0.7, color = "red", linetype = "dashed") +
  geom_vline(xintercept = 0, color = "orange", size = 1.3, linetype = "dashed") +
  theme_minimal() +
  xlim(c(-0.05, 0.05))
```



c

```
model_data <- data_clean %>%
  mutate(D = ifelse(demvoteshare > 0.5, 1, 0))

mod <- lm(dwnom ~ demvoteshare_t + D + demvoteshare_t*D, data = model_data)
se <- sqrt(vcovHC(mod, type="HC")["D", "D"])
```

```r
ci <- mod$coefficients["D"] + 1.96*c(-1,1)*se

data.frame(
  est = mod$coefficients["D"],
  lower = ci[1],
  upper = ci[2]
)
```

```
         est      lower      upper
D -0.6146356 -0.6277378 -0.6015333
```