CA4VdVeen

Ties van der Veen

1-3-2020

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I. Preliminaries

```
#Clearing the workspace
rm(list = ls())
```

```
options(repos="https://cran.rstudio.com")
install.packages("pwr")
```

```
## package 'pwr' successfully unpacked and MD5 sums checked
##
## The downloaded binary packages are in
##  C:\Users\tiess\AppData\Local\Temp\RtmpkJXAac\downloaded_packages
```

```
library(foreign)
library(tidyverse)
library(ggdag)
library(dplyr)
library(tinytex)
library(jtools)
library(huxtable)
library(summarytools)
library(ggstance)
library(pwr)
library(knitr)
library(lemon)
library(AER)
library(lubridate)
library(ggplot2)
library(plm)
library(pwr)
```

II. What to submit

```
theUrl_ca4_ectrics2 <- "https://surfdrive.surf.nl/files/index.php/s/uWdWgE18hCYE4LS/download"
experiment <- read.dta (file = theUrl_ca4_ectrics2)
```

(a)

```r
reg1 <- plm(violations ~ treatment_dummy_2, data=experiment, effect="twoways",
            model = "within", index=c("month"))
coeftest(reg1, vcov=vcovHC(reg1, cluster="group"))
```

```
##
## t test of coefficients:
##
##                    Estimate Std. Error t value Pr(>|t|)
## treatment_dummy_2  -1.2333     1.1326 -1.0889   0.2898
```

```r
#Not 100% confident this is the right way to test this, would like input on that.
```

(b)

My results suggest a 1.23 point decrease in violiations after the treatment period. Nonetheless, a difference in the outcome ranging from a 0.1007 point decrease to a 2.3659 point decrease is also reasonably compatible with our data, given our assumptions.

(c)

Treatment effect = -1.2333

Standard deviation is the standard error times square root of n

```r
SD = 1.1326*sqrt(42)
print(SD)
```

```
## [1] 7.340087
```

So the effect size is

```r
-1.2333/SD
```

```
## [1] -0.1680225
```

Chance treatment works = 0.25 Significance level = 0.05

```r
pwr.t.test(n=42,d=-0.1680225,sig.level=0.05,power = NULL,
           type = c("two.sample"),alternative="two.sided")
```

```
##
##      Two-sample t test power calculation
##
##               n = 42
##               d = 0.1680225
##       sig.level = 0.05
##           power = 0.1185235
##     alternative = two.sided
##
## NOTE: n is number in *each* group
```

So the power is rather low, 0.1185235.

What we want to know: P(treatment doesn't work|test-) = P(test-|doesn't work) * P(doesn't work) / P(test-) = Power * P(doesn't work) / P(test-) = Power * P(doesn't work) / (Power * P(doesn't work) + P(test-|works)*P(works))

```r
power = 0.1185235

print(power*0.75 / ((power * 0.75) + (0.05 * 0.25)))
```

```
## [1] 0.8767169
```

So the chance the that treatment doesn't work when the test is negative is 0.8767, or 88%. Seems rather high, not sure I got the formula correct. I tried to translate it from the slide "Strength of evidence of a statistically significant finding from a well-powered study".

(d)

First we calculate the effect size:

```r
SD2 = 1.2*sqrt(42)
print(1.2/SD2)
```

```
## [1] 0.1543033
```

Running the power test again:

```r
pwr.t.test(n=42,d=0.1543033,sig.level=NULL,power = 0.4,
           type = c("two.sample"),alternative="two.sided")
```

```
##
##      Two-sample t test power calculation
##
##               n = 42
##               d = 0.1543033
##       sig.level = 0.2891634
##           power = 0.4
##     alternative = two.sided
##
## NOTE: n is number in *each* group
```

The significance level she must have found is very close to the one we found under (a), namely 0.2898. So her finding seems to be consistent with ours.

(e)

1-(answer found for c) = 1-0.8767169

```r
newprior = 1-0.8767169
print(newprior)
```

```
## [1] 0.1232831
```

P(works) is 0.25 as given earlier.

As from the slide "Strength of evidence of a statistically significant finding from a well-powered study", we have

Power * P(works) / (Power * P(works) + P(test+|doesn't work)*P(doesn't work))

```r
print(power*0.25/(power*0.25 + 0.05*0.75))
```

```
## [1] 0.4413897
```

So now there's a 44% chance that the treatment works if there is a positive test. Not sure what the new test under (d) has to do with this?

(f)

With a bias of 0.2, 20% of the negative tests goes into the positive test category (increasing false positives and reducing true negatives). Not sure how to calculate this?