Practice Final (Classwork 17)

EC421 Fall 2022

November 29, 2022

The final exam will be in-person (closed-note, completed individually) on Thursday, December 8th at 2:45pm. It will have the same format as the midterm: 30 multiple choice questions (each worth 1.5 points), 10 short answer questions (each worth 4 points), and 10 tidyverse questions (each worth 1.5 points).

The final will be cumulative, but heavily weighted toward material from the second half of the course (workbook chapters 7-11). Specifically, half of the multiple choice questions will be from the first half of the course. The short answer and tidyverse questions will be all focused on the material from the second half.

1 Multiple Choice (1.5 points each)

Use this information to complete questions 1-3:

Consider the market for Colgate toothpaste, where demand is given by:

$$q = \beta_0 + \beta_1 p_{colgate} + \beta_2 p_{crest} + u$$

And supply is given by:

$$q = \alpha_0 + \alpha_1 p_{colgate} + v$$

Where u includes the effects of demand shifters other than the price of Colgate's competitor Crest, and v includes the effects of supply shifters.

1. If we ran the regression `lm(q ~ p)`, would we identify α_0 and α_1, or β_0 and β_1?

   (a) Both

(b) Neither

(c) α_0 and α_1

(d) β_0 and β_1

2. If the price of Crest toothpaste _____ the price of Colgate, the price of Crest could be a valid instrument for the price of Colgate.

   (a) affects

   (b) does not affect

3. It might be possible to use the price of Crest toothpaste as an instrumental variable to estimate _____.

   (a) α_1

   (b) β_1

   (c) Both α_1 and β_1

4. (T/F) If y_t is a random walk, then $Var(y_t)$ increases with t.

   (a) True

   (b) False

5. Suppose a time series process is stationary. Then (select all that apply):

   (a) $E[y_t] = 0$

   (b) $E[y_t] = E[y_{t+k}]$ for all k

   (c) $Var(y_t) = Var(y_{t+k})$ for all k

   (d) $Var(y_t) = 0$

   (e) $Cov(y_t, y_{t+k}) = 0$ for all k

6. If shocks u_t in a time series process like the one below are autocorrelated, then in general (select all that apply):

   $y_t = \beta_0 + \beta_1 x_t + u_t$

   (a) OLS estimates will be biased

   (b) OLS standard errors will be incorrect

   (c) OLS estimates will be inconsistent

7. (T/F) An instrument z is excludable if it affects y (the outcome) only through how it effects x (the endogenous explanatory variable).

   (a) True
   (b) False

8. The key assumption for the differences-in-differences research design to be valid is:

   (a) Exogeneity
   (b) Stationarity
   (c) Parallel trends
   (d) No time trends

2 Tidyverse (1.5 points each)

1. What is the difference between `map()` and `map_dfr()`?

2. Use `map()` to multiply each element of the vector 1:5 by 2. You can use a named function, an anonymous function, or a formula.

3. Use `map()` to generate 10 random numbers from N(-5, 1), 10 random numbers from N(0, 1), and 10 random numbers from N(5, 1). Use a formula to do so.

4. Repeat the previous problem's solution, this time using an anonymous function.

5. Fill in the blanks with integers so that the code below will return TRUE's:

   ```
   accumulate(c(__, -3, __, -2), `+`) == c(5, __, 8, __)
   ```

6. Fill in the blanks with integers so that the code below will return TRUE's:

   ```
   accumulate(c(__, __, __, __), ~ 1 + 2*.x + .y) == c(0, 4, 0, 3)
   ```

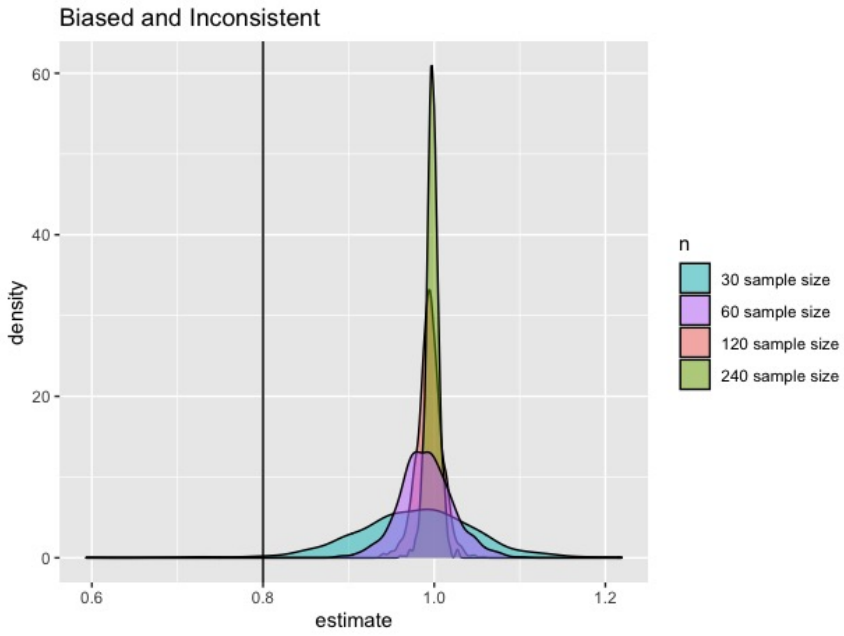
7. Generate a random walk using `accumulate`.

Use this information to solve questions 8-10:

This is a monte carlo simulation that shows, for an autocorrelated series y where u is also autocorrelated, OLS estimates will be biased and inconsistent. Fill in the blanks to complete the simulation.

```
sim <- function(samplesize) {
  map_dfr(
    1:1000,
    function(...) {
      tibble(
        u = accumulate(rnorm(n = samplesize), `+`),
        y = accumulate(u, function(y, u) .8 * y + u)
      ) %>%
        lm(___, data = .) %>%
        broom::tidy() %>%
        select(estimate) %>%
        slice(2) %>%
        mutate(n = paste0(samplesize, " sample size"))
    }
  )
}

sim(samplesize = 30) %>%
  add_row(sim(samplesize = 60)) %>%
  add_row(sim(samplesize = 120)) %>%
  add_row(sim(samplesize = 240)) %>%
  ggplot(aes(___)) +
  geom_density(alpha = .5) +
  geom_vline(___) +
  ggtitle("Biased and Inconsistent")
```



8. Fill in the first blank: `lm(___, data = .)`
9. Fill in the second blank: `ggplot(aes(___)) +`
10. Fill in the third blank: `geom_vline(___)`