

# PUBPOL 6090 Lecture 3 Notes

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## Agenda

- Monte carlo
- measurement error
- CEF

## Reading

- Two star readings coming up for next Tuesday/Thursday

## Notes

### Monte carlo is an alternative method of learning new econometric methods

- It is also used in bootstrapping to achieve a standard error and in circumstances where we need to create a standard error (e.g., null distribution with Synthetic control)
  - \* Monte carlo can be used to answer questions about a method in non-standard cases (e.g., RD with binned age rather than continuous age)

### Generating data

- \* We know the true  $\beta$  and we can compare the means of the estimated  $\hat{\beta}$  and we would hope that it is close to the true mean
  - The  $SE$  of the  $N$  simulated  $\beta$ s is the quantity that we want to estimate with the  $\hat{SE}$ . The goal of estimation is to approximate the standard deviation of the distribution of beta hat.
- \* We compare the test statistic with an estimate  $\hat{SE}$  we are estimating the statistic with noise because we do not have the *true* standard deviation. If we had the true standard error, we could compare the test statistic to the standard normal distribution
- When we switch from  $SE$  to  $SE_r$  we get a standard error which is unbiased but we get more variability. We get a smaller reject rate as well.
- Can we know the form of heteroskedasticity?
  - Sometimes

### Conditional expectation function

$$E[Y|X]$$

- Useful quantity of interest for both descriptive and causal work
  - \* This tells us about the average Y value when X takes on a particular value
- Regression can be useful for estimating it
- Properties

- \* If this function, no matter how complicated, is linear OLS is the best linear estimator
  - In the case where the  $X$ s are dummy variables, that makes the equation a linear function
    - OLS is the best we can do. (Think LPM)

### Measurement error

- Attenuation result
  - Measurement error on the RHS,  $u_x$  is the measurement error which is uncorrelated with everything
    - \* We want to observe  $X^*$  but we can only observe  $X$  ests up attenuation result (page 12 of the slides) for 8/29
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