EMLE Empirical Legal Studies
Spring 2020
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Exam

1. What is the relationship between variance and standard deviation? Is there any reason to use one versus the other in an analysis?

   The standard deviation of x is the square root of the variance of x. While both give a metric of the volatility of x around its mean, the standard deviation is measured in the same units as x, while the variance is measured in the squared units, which may be less intuitive.

2. In the regression model y = a + b*x, what is the interpretation of the regression estimate b.

   Mechanically, the slope coefficient tells us how much y changes on average for a one unit increase in the x variable.

3. What does it mean if the estimate of b in the regression above is statistically significant?

   Statistical significance tells us whether the relationship between x & y (i.e., b) observed in the analyzed sample is unlikely to have been observed by mere chance if the relationship between x & y in the population were actually 0.

4. What factors does the determination of statistical significance depend on?

   The determination of statistical significance depends on the effect size (i.e., the b coefficient), the standard error of the effect size (which depends itself critically on the sample size as well as the underlying variation in the effect estimate), the null hypothesis (often this will be 0), and the type 1 error used for hypothesis testing (often 5% spread between the two tails).

5. Can an estimated effect be statistically insignificant but still substantively important? Explain your answer.

   Statistical significance is different from substantive importance. One can have a statistically significant estimate that is substantively irrelevant or unimportant, just as one can have a statistically insignificant estimate that is potentially substantively important. The latter can arise when the estimate is imprecisely estimated because there are few data points available or the underlying phenomenon is very volatile. In such a case, depending on the substantive question, the insignificant estimate might still be helpful in decision making terms.

6. What is the purpose of using a control group in a randomized experiment?

The control group provides us with a measure of the counterfactual outcome (i.e., what would have happened if the treatment had not been administered to the treatment group). Intuitively, it accounts for unobservable background trends/changes that should not be conflated with the treatment effect.

7. Can non-linear effects be estimated in an ordinary least squares regression? If so, provide an example of how this could be done.

Yes. One could include the x variable as a polynomial (x, x^2, x^3, etc). One could also turn the x variable into a set of categorical dummy variables (e.g., one if x is between 0 and 10, another if x is above 10 but no greater than 20, and so on). One could also do other transformations such as taking the logarithm of y (to linearize an exponential relationship). Etc.

8. What conditions are necessary for an omitted variable bias to arise in the estimation of regression coefficients?

First, one or more than one of the x's that matter (i.e., are part of the underlying causal model) for y are omitted from the regression. Second, the omitted x (or x's) are correlated with [one, some, or all] of the x's that are included in the regression.

9. Choose one question from 1-8 to count double.

Basically everyone got question 2 correct, so you should have chosen that one probably.

10. Choose a different question (i.e., not the one you chose for #9) to count double.

90% of people got question 8 correct, so you probably should have chosen that one.

11. What specific (i.e., don't simply say "there is no omitted variable bias") assumptions are required to treat the estimates from a fixed effects model as representing causal effects?

The effect of important (i.e., meet the conditions for omitted variable bias) unobservable/uncontrolled for effects is fixed/constant at the entity level (and therefore are accounted for by the entity fixed effect) or to the extent the effects change over time, they change similarly for all entities (and therefore are accounted for by the time period fixed effect).

12. Describe the general approach known as propensity score matching.

A model is estimated where the outcome variable is the treatment variable and the x's are the relevant covariates. Then treated and untreated observations are matched on the

basis of the predicted propensity/likelihood of being treated based on the first step model (e.g., if the model suggests that a given observation that is actually treated had a likelihood of receiving treatment of 65%, it is matched with an untreated observation that likewise had a predicted likelihood of treatment of 65%). Unmatched observations are discarded. The average outcome of the treated matched units is compared to the average outcome of the untreated matched units, with the difference between the two being used as the treatment effect estimate.

13. How can falsification tests be used to increase confidence in estimates from a regression discontinuity model?

The assumption in RD models is that units on either side of the discontinuity (within some range) are comparable to each other but for the treatment that occurs at the discontinuity. If one examines how other variables change at the discontinuity, the assumption of similarity mighty be "falsified" if one finds that other characteristics change at the discontinuity as well.

14. Explain why a very convincing natural experiment analysis might be high on internal validity (or reliability) but low on external validity (or relevance).

The unique circumstances that gave rise to the credible natural experiment may suggest that the setting itself is so unique that extrapolation to other settings may be doubtful.

15. What is the parallel trends assumption? Is it necessary for a causal interpretation of the results in a panel data regression? Why or why not?

Comparators (i.e., untreated entities) are used to provide the counterfactual for the treatment entities (i.e., what would have occurred for the treatment entities had they not been treated). In this sense, we need to assume that the comparators would have exhibited the same trends post treatment as the treatment entities, but this is not observable. So, instead, people focus on whether the comparators and the treatment entities exhibit parallel trends in the pre treatment period, assuming that if the two groups exhibit comparable trends before the treatment, they would have exhibited comparable trends in the counterfactual post treatment period in which the treatment does not occur. Obviously, it could be the case that the two groups could have had comparable trends in the counterfactual post treatment period without having had comparable trends in the pre treatment period, but this is unverifiable.

16. Interpretation of liability regressions

First Regression: Compared to the jurors group, judges rate the liability as 0.6 points lower, and the effect is statistically significant. Compared to the situation where no inadmissible evidence was presented, decision-makers shown inadmissible evidence rated liability 1.1 points higher, and the effect is statistically significant.

Second Regression: Compared to the jurors group, judges rated liability 0.0 points higher, but the effect was not statistically significant, suggesting that any judge/juror differential could be the result of random variation. Compared to decision makers not shown inadmissible evidence, those shown inadmissible evidence rated liability 1.6 points higher, and the effect was statistically significant. Lastly, the interaction effect suggests that judges shown inadmissible evidence rated liability 1.3 points lower than jurors shown inadmissible evidence, and this interaction effect is statistically significant. Essentially, the effect of inadmissible evidence is driven by jurors, not by judges.

17. Basically nobody picked this one and I'm not drawing the graph here. See Pieter if you want to know the answer.