

Policy Evaluation – PMAP 8131

QUIZ: CAUSALITY

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1. (1 point) Starting in 2001, the GRE was phased out as a mean of fulfilling Mensa's entry requirements because of the loose correlation between GRE test scores and IQ. What is Mensa worried about?
 - A. Differential mortality
 - B. General equilibrium effects
 - C. Instrumentation**
 - D. Causality

Solution: Mensa is worried about the GRE test being too weak of an instrument for an IQ test.

2. (1 point) Many graduate programs are ditching GRE for admissions because GRE test scores seem to predict coursework outcomes (i.e., GPA, time-to-completion, comprehensive exams, etc.), but not broader academic and job market outcomes (i.e., conference participation, publications, placement, etc.). What is the issue here?
 - A. Differential mortality
 - B. General equilibrium effects
 - C. Instrumentation**
 - D. Causality

Solution: Again, instrumentation. GRE instruments broader program outcomes in a much weaker way than it predicts narrower coursework outcomes. Therefore, the instrument is weak for the task at hand.

3. (1 point) One concern of COVID-19 research is that individuals with the most risk of experiencing severe patient outcomes were also the most likely to be affected by all other diseases during that same time-frame. What is the potential threat to the validity of COVID-19 fatality rate calculations?
 - A. Self-selection
 - B. Regression to the mean
 - C. History effects
 - D. Maturation effects**

Solution: The concern is that part of what we are observing is maturation effects. At-risk patients would have "matured" to the terminal stage of their lives regardless of the virus.

4. (1 point) Motivation, which is not observed, positively affects grades and grades positively affect individual earnings. A model estimating the relationship between grades and earnings is likely to do what?
- A. Underestimate the relationship between grades and earnings
 - B. Overestimate the relationship between grades and earnings**
 - C. Return patterned error terms
 - D. Both A) and C)

Solution: The unobserved variation attributable to motivation affects the explanans, grades, and the explanandum, earnings, at the same time. Therefore, part of the positive effect that grades have on earnings would go away if motivation were observed and included in the model. The relationship between grades and earnings is therefore likely to be overestimated.

5. (1 point) A researcher is comparing across two different models. Model B returns a much higher R^2 than model A's. However, none of the predictors added to model B which was not already present in model A is significant.
- A. The researcher should keep all of the predictors
 - B. The researcher should keep none of the predictors
 - C. The researcher should one predictor at random
 - D. Not enough information provided**

Solution: There is not enough information to take the decision. Because R^2 is higher for model B, it must be that one or more of the predictors are significantly related to the dependent variable. However, it is impossible to determine how many nor is it generally possible to say anything conclusive about a model specification when the functional form is unknown. Keeping one or all of the predictors is surely wrong, and keeping all might only be decided based on the data generating process for the dependent variable.

6. (1 point) Calculate the sample covariance between SAT test score and math GPA.

stud_id	math	SAT
001	2.7	1,250
002	3.9	1,400
003	3.2	950
004	3.5	1,500

- A. 0.46
- B. 0.69
- C. 7.47
- D. 55.83**

Solution: Using the covariance formula: $\frac{\sum_{i=1}^4 (math_i - \overline{math})(SAT_i - \overline{SAT})}{4-1} = 55.83$.

7. (1 point) The Duhem-Quine thesis _____ Popper's falsification principle while arguing that _____ individual observation is sufficient to make an inference invalid.

- A. [accepts, no]
- B. [accepts, any]
- C. [rejects, no]
- D. [rejects, any]

Solution: The Duhem-Quine thesis accepts Popper's modus tollens; however, it views theories as consisting of a plurality of scientific statements. Failure to realize theoretical predictions renders at least one of the statements incorrect, but determining which one is impossible without any further work. Therefore, one confutation is never sufficient to declare a theory invalid.

8. (1 point) A researcher is interested in the relationship between earnings and education conditional on individual demographics (e.g., age, gender, etc.) stored in a vector X . She runs the model $wage_i = \alpha + \beta education_i + \delta X_i$ and VIF analysis reveals multicollinearity in the demographic controls.
- A. Multicollinearity of the control variables is never an issue
 - B. Multicollinearity of the control variables is always an issue
 - C. Multicollinearity of the control variables is not an issue with causal inference, and therefore is not an issue here**
 - D. Multicollinearity of the control variables is not an issue with prediction, and therefore is not an issue here

Solution: Multicollinearity of factors which we are controlling for is not an issue if our goal is to estimate the conditional and causal relationship between an independent variable (i.e., education) and the dependent variable (i.e., earnings). Multicollinearity is generally an issue with prediction because it might yield unstable models.

9. (1 point) The policy analysis team took stance against running any program evaluations during the COVID-19 pandemic. They worry that _____ external validity might suffer due to inability to tease out effects of programs from pandemic-induced outcomes. They are thus concerned with _____.
- A. [internal, reaction to measuring]
 - B. [external, reaction to measuring]
 - C. [internal, multiple treatments]**
 - D. [external, multiple treatments]

Solution: Whenever the experimental variable is non-exogenous, it is unclear that the estimate treatment effect is down to the variable itself as opposed to the confounder(s).

10. (1 point) A researcher specifies individual earnings as a function of ethnicity (β_1), education (β_2), and experience (β_3). She hypothesizes that ethnicity has no independent effect on earnings which is not mediated by either education or experience. For her hypothesis not to test false, what has to happen when running the regressions below?

$$wage_i = \beta_0 + \beta_1 ethnicity_i \tag{1}$$

$$wage_i = \beta_0 + \beta_1 ethnicity_i + \beta_2 education_i + \beta_3 experience_i + \epsilon_i \tag{2}$$

- A. β_1 is statistically significant in neither model 1) nor model 2)
- B. β_1 is statistically significant in both model 1) and model 2)
- C. β_1 is not statistically significant in model 1) and significant in model 2)
- D. β_1 is significant in model 1) and not statistically significant in model 2)**

Solution: It must be that the coefficient on ethnicity in model 1), significant, becomes insignificant when conditioning for the mediators education and work experience.