Exam: midterm #2

This is a preview of the published version of the quiz

Started: Nov 2 at 7:49pm

Quiz Instructions

Note carefully the time limit/deadline. You may only submit once; after you submit, you may not change your responses.

You may use any physical notes you want, as well as the digital version of our textbook (access your version of choice from **my website here** **(https://kaplandm.github.io/teach.html)**) including the linked YouTube videos, **Wikipedia** **(http://en.wikipedia.org/)** , our Canvas site, and any PDF/.txt/etc. files on your computer that you can view through your web browser by entering a "URL" (location) starting with file:/// such as file:///C:/Users/kaplandm/Papers/Risk_mgmt/Acerbi_2002.pdf. But, **you may not consult with any other person or artificial intelligence** (whether in person, by text/chat, email, etc.), nor may you use any search engine.

Honorlock will be used to record your screen and you (via webcam/mic) and your web traffic, and I plan to review each recording even if unflagged.

If you have any technical difficulties, I suggest sending me a very short message in Canvas (like just "Hi, I'm having some technical difficulties but trying to resolve them") for documentation, and then trying to resolve them through the Honorlock tech support (chat) or MU Canvas tech support (855-675-0755) depending on the problem. And keep me updated as needed.

There is no penalty for guessing.

Good luck!

Honorlock Chrome Extension

This assessment requires Google Chrome and the Honorlock Chrome Extension.

Language

English (United States)

Extension Added

Please navigate back to your Learning Management System and begin your assessment.

Need Help? **Chat with our support team now**

Question 1 1 pts

I hereby pledge to follow the exam instructions and certify that my responses represent my efforts alone: I have not communicated with any other humans about this exam, and I have not used any artificial intelligence. (Per instructions, textbook/notes/Wikipedia/etc. are still fine to consult.)

- True
- False

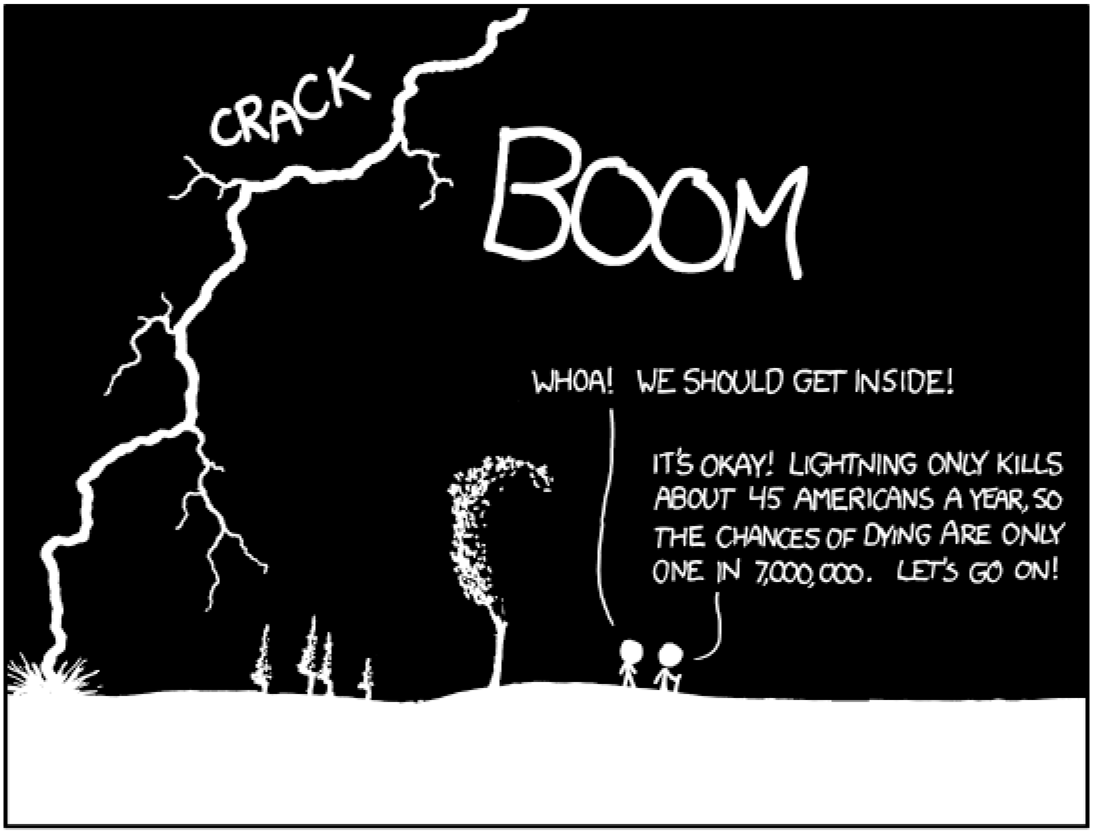
Question 2 1 pts

The OLS residuals

- should not be used in practice since they indicate that your regression line does not run through all your observations.
- can be calculated using the errors from the regression function.
- are the actual values minus the fitted values.
- are unknown since we do not know the population regression function.

Question 3 1 pts

Consider the following comic (https://xkcd.com/795/):



THE ANNUAL DEATH RATE AMONG PEOPLE WHO KNOW THAT STATISTIC IS ONE IN SIX.

One key to understanding the comic is knowing that

- 45 deaths per year is an average; it could easily increase by 2 people this year
- the correlation between being outside during lightning and dying is not necessarily a causal effect.
- 1/7,000,000 is an unconditional probability that's lower than the probability conditional on being outside during a lightning storm
- 1 in 7 million is very small, but it still happens 45 times per year because there are hundreds of millions of Americans

Question 4 1 pts

	Rain (X=0)	No rain (X=1)
Long commute (Y=0)	0.2	0.1
Short commute (Y=1)	0.4	1–0.2–0.4–0.1

The above table gives the joint probability distribution of weather conditions and commuting times for May 1. Conditional on there being rain, the probability of a short commute is (round to 2 decimal places, like 0.55)

Question 5 1 pts

You have collected data on the distance from campus to home (D) and grades (G) for Mizzou students. Changing the measurement units of D from kilometers to meters transforms E(G | D=5km) to E(G | D=5000m) by

- dividing by 1000
- multiplying by 1000
- [not enough information]
- [none of these]

Question 6 1 pts

Let Y be points scored out of 100 possible on an introductory physics final exam. The physics professor randomly assigned students to have either X=90 minutes or X=120 minutes on the exam. The estimated intercept was 49pts, and the estimated slope was 0.24pts/min. Based on this, if the same exam were instead given during a 100-minute lab period, we'd predict

- a score distribution with mean around 73
- each student will score 83, since no error term is estimated
- nothing: can't predict because not a causal estimate
- mean score 63-65pts, with some students below and some above

Question 7 1 pts

Imagine two studies. Both look at Y=violent crimes per capita as the outcome. Both use the same measure (published by a third party) of strictness of gun control laws, letting X=1 if strict and X=0 if not. The first uses a cross section of countries in the world, and uses OLS to estimate the CMF slope in a regression of Y on X, estimating a slope of -3. The second uses a cross section of states within the U.S. to estimate the regression slope, estimating a slope of +3. The first estimate ____ be interpreted as an estimate of an average structural/treatment effect; the second estimate ______ be interpreted as an estimate of an ASE/ATE.

- ○ cannot; cannot
- ○ can; can
- ○ can; cannot
- ○ cannot; can

Question 8 1 pts

The word "best" in "best linear predictor" means

- ○ is closest to Y at as many x values as possible
- ○ most likely to predict what happens following a policy change
- ○ minimizes expected squared distance from Y
- ○ [none of these]

Question 9 1 pts

The linear projection of Y onto (1,X)

- ○ is equivalent to the fully saturated CMF model when X has 3 possible values
- ○ is equivalent to the best predictor of Y given X
- ○ is equivalent to E(Y | 1,X)
- ○ [none of these]

Question 10 1 pts

Which of the following is NOT used by the theorem showing consistency of the OLS estimator of the linear projection coefficients?

- ○ finite variance of Y and X
- ○ conditional normality of Y (given X=x)
- ○ iid sampling

○ non-constant X

Question 11 1 pts

Consider a simple linear regression using U.S. data, where Y is years of education completed and X is distance from parents' house (where the individual lived as a child) to the nearest research university measured in units of ten thousands of miles; for example, X=1 indicates a distance of 10,000mi (=16,093km). You run OLS, computing $\hat{\beta}_1 = -0.09$ with a 95% CI of [-0.22, 0.04]. (Note for international students: the U.S. is big, so although most people live within 50km of the nearest research university, many live 50-150km from the nearest research university.) Among the following, the most reasonable interpretation is:

○ we can feel fairly certain that the true population linear projection slope equals zero.

○ the true slope is very likely economically significant, but we're uncertain of the sign (positive or negative).

○ educational attainment (Y) clearly decreases with distance from research university (X), but it's not at all clear that this is causation vs. merely correlation.

○ we can feel fairly certain that the statistical association between Y and X is not economically significant.

Question 12 1 pts

Let Y denote a firm's profit margin as a decimal/proportion, where typical values in the industry you're studying are from Y=0.00 to Y=0.15 (note for example 0.15=15%). Let X denote the percentage of a firm's employees who have an economics degree; for example, X=6 means 6%. You run OLS, computing a slope estimate of 0.04 and 95% CI of [0.02, 0.06]. Among the following, the most reasonable interpretation is:

○ we feel fairly sure that there is an economically significant positive statistical relationship between X and Y in the population.

○ we feel fairly sure that there is no relationship between firm profit margin and employees having economics degrees, for practical purposes.

○ our best guess is that there is a positive relationship between employees having economics degrees and a firm's profit margin, but there is so much uncertainty that we would not be surprised if there is actually no relationship or even a negative relationship.

○ for most firms (95%), there is a positive benefit of hiring a higher proportion of employees with economics degrees.

Question 13 1 pts

ln(Y) = a + b ln(X) + U is called a ____ model.

- linear
- log-linear
- linear-log
- log-log

Question 14 1 pts

An example of a quadratic model is

- $Y = (a + bX + U)^2$
- $Y^2 = a + bX + U$
- $Y = a + bX + cX^2 + U$
- $Y = a + bX + U^2$

Question 15 1 pts

In nonparametric regression, we try to estimate

- the model $\mathbf{E}(Y \mid X = x) = \beta_0 + \beta_1 x + \beta_2 x^2 + \cdots \beta_k x^k$.
- a qualitative relationship between Y and X
- the CMF without knowing its functional form
- the variables, not the parameters

Question 16 1 pts

In the log-log model, the slope coefficient is best described as

- the percentage effect that a unit change in X has on Y
- the elasticity of Y with respect to X
- the predicted change when multiplying by U (not adding)
- the coefficient of determination

Question 17 1 pts

You ran OLS and estimated $\hat{Y} = 50.3 - 0.001X + 0.001X^2$, where Y is a school district's average 4th-grade math test score and X is the average annual per capita household income in the school district, measured in thousands of dollars per year (e.g., X=1 means $1000/yr), which ranges from X=20 to X=200 in the population of interest. The estimated function

- suggests a negative relationship between test scores and income for low incomes, but positive for high incomes
- is negative until X=21.81
- does not make sense because it involves the square of income, which here has units ($\$^2/\text{yr}^2$)($10^6$)
- suggests a positive relationship between test scores and income for all of the population

Question 18 1 pts

You are interested in the ideas of Deaton and Paxson (1998, "Economies of scale, household size, and the demand for food"), so you get a dataset of consumption expenditures on different types of goods from different households. The Y variable is the budget share (like 0.2 for 20% of total budget) of a particular good (e.g., food, housing, alcohol); X is the total per-capita expenditure of the household. To start, you wish to estimate the CMF E(Y|X=x) separately for households of different sizes (e.g., 1 adult 0 children; 2 adults 2 children; etc.). Your economic theory says that the CMF is always "monotonic": it is always increasing (at all x) for some goods, and always decreasing (at all x) for others, but never switches from increasing at some x to decreasing at another x. This implies the CMF must have a ____ functional form. (Hint: you can check your answer by thinking about the contrapositive; i.e., if the CMF is not ____, does that imply it is not monotonic?)

- linear
- cubic polynomial
- log-linear
- [none of these]

Question 19 1 pts

The parallel trends assumptions states that

- as a function of time, the mean untreated potential outcome for the actually-treated group is flat

○ if there had not been any treatment, the average before/after change in the treated group would have been the same as the average before/after change in the untreated group

○ plotting the mean treated and untreated potential outcomes over time, each pair of segments (over the same time period) is parallel

○ [none of these]

Question 20 1 pts

You regress Y on X and estimate a slope coefficient near zero. Then you regress Y on X and W, estimating a large slope coefficient on X. This suggests that your first regression might suffer from

○ heteroskedasticity

○ perfect multicollinearity

○ omitted variable bias

○ moiré patterns

Question 21 1 pts

As the sample size increases, the magnitude (i.e., absolute value) of omitted variable bias

○ goes to zero

○ decreases significantly, but never exactly to zero

○ increases without bound (toward ∞)

○ [none of these]

Question 22 1 pts

Consider the CMF model $Y=\beta_0+\beta_1 D+\beta_2 F+\beta_3 DF+V$, where Y is annual earnings in dollars, D=1 if the individual has a college degree (and D=0 otherwise), and F=1 if the individual is female (and F=0 otherwise). The interpretation of β_3 is

○ the average difference between {the earnings premium of having a college degree (vs. not) for females} vs. {the earnings premium of having a college degree (vs. not) for non-females}

○ the average earnings differential between college degree holders and others for the subpopulation of females

○ the average earnings differential between females and non-females for the subpopulation of college degree holders

○ the mean earnings in dollars for the subpopulation that both is female and holds a college degree

Question 23 1 pts

Consider the CMF model $E(Y \mid S,M)=\beta_0+\beta_1 S+\beta_2 M+\beta_3 SM$, where Y is college grade point average (GPA) for undergraduates here, S=1 if the individual receives a scholarship (and S=0 otherwise), and M=1 if the individual is in-state (and M=0 otherwise). The interpretation of β_2 is

○ the mean GPA difference between in-state and out-of-state students

○ the mean GPA difference between in-state and out-of-state students within the subpopulation of individuals without a scholarship

○ the mean GPA for the subpopulation that both is in-state and didn't receive a scholarship

○ the difference between average GPA for in-state students without a scholarship and the unconditional population average GPA

Question 24 1 pts

You observe traffic fatality rates by U.S. state in 1980 and 1990 ("before" and "after"). In between, some states adopt a high beer tax rate (the "treatment"), while others don't ("untreated"). Which of the following is NOT a reason to doubt the parallel trends assumption?

○ tax rates on other alcohols: states that increased beer tax were also more likely to have increased taxes on other alcoholic beverages during the same time period

○ legal penalties for drunk driving: state legislatures concerned about traffic fatalities tended to address drunk driving deaths by simultaneously increasing beer tax along with direct legal penalties for drunk driving

○ car safety features: increased national safety standards only affected new cars, so poor states (that were less likely to have increased beer tax) do not see a big rise in safety features, while rich states (that were more likely to have increased beer tax) do see a big rise in car safety features

○ [none of these]

Question 25 1 pts

An interaction term makes a function more flexible by allowing

○ the slope with respect to one regressor to depend on its value

○ the intercept to shift up or down arbitrarily

○ the slope with respect to one regressor to depend on the value of the other regressor

○ [none of these]

Question 26 1 pts

Let Y be hourly wage, X_1=1{female}, X_2=1{married}, X_3=years of education, X_4=years of experience, and you also include the squares of X_3 and X_4. Of the following, the biggest reason to suspect OVB is

○ women are more likely to be married than men, but X1 and X2 are treated symmetrically

○ married individuals tend to live in larger houses, which is not observed

○ unobserved traits like working hard or intelligence are positively correlated with education but also have a direct effect on wage

○ the first year of experience is very valuable, but each successive year is decreasingly valuable

Question 27 1 pts

Let X denote a continuous regressor, and D is a binary regressor. Which of the following specifications does NOT make sense?

○ Y = a + bX + cD + dXD + U

○ Y = a + bX + cXD + U

○ Y = (a+D) + bX + U

○ Y = a + bX + cD + U

Question 28 1 pts

Consider the model $Y = a + bX_1 + cX_2 + dX_1X_2 + U$. Holding X_1 and U constant, a 1-unit increase in X_2 changes Y by

○ $b+dX_2$

○ $c+dX_1$

b+d

[none of these]

Question 29 1 pts

Consider a regression with school district-level data, where T=average test score, R=student-teacher ratio, and H=1 if the percentage of students who are English learners (non-native speakers) within a school district is above 10% (and H=0 otherwise). Consider the specification $T=\beta_0+\beta_1R+\beta_2H+\beta_3RH+U$. The estimated regression function computed with OLS is 480-R+24H-1.2RH. For a student-teacher ratio of 10, the predicted average test score for districts with >10% English learners minus the predicted value for other districts is _____ points

-12

12

-18

[none of these]

Question 30 1 pts

(Based very loosely on Koedel, Li, Polikoff, Hardaway, and Wrabel (2017), "Mathematics curriculum effects on student achievement in California")

Let Y be a school's average standardized math test score among 3rd-graders, let D=1 if the school adopted the "California Math" textbook by Houghton Mifflin, and let other regressors include school characteristics such as % of students in different groups (female, English learner, economically disadvantaged, white, black, Asian, Hispanic), enrollment (and its square and cube), and pre-adoption (baseline) average math score; and district and zip code characteristics (like income and adult education levels). You believe that the CMF is linear in these variables (except as noted above) and that conditional on all the other regressors, the textbook adoption decision was independent of unobserved determinants of math test score. In that case, after regressing Y on D and all the other regressors (including an intercept), you would interpret the estimated coefficient on D as an estimate of the

linear projection slope with respect to the California Math dummy

mean Y difference between a subpopulation of schools who use California Math and a subpopulation who don't but otherwise look identical (i.e., same values of "other regressors")

- ○ average structural effect of using California Math on average math score
- ○ [all of these]

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