Political Methodology Comprehensive Examination, August 2020
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Instructions: *Read all questions before answering any of them. When you use substantive examples in your answers, we strongly prefer to see examples from political science. Answer all questions in part I. Answer 3 questions in part II (or the game theory question and one other). If you are completing the exam at GW, feel free to hand-write answers or parts of answers in a blue book, but carefully label them and note that you are using the blue book in your typed document. If you are completing the exam at home, you can similarly include photos/scans of hand-written material. Good luck!*

Part I

1. You are reviewing an article in which the authors point to a high R-squared statistic as evidence supporting the strength and validity of their regression model. What is the R-squared statistic, how is it calculated, and how should it be interpreted? As a reviewer, how would you respond to authors making such an argument?

2. You're teaching your first stats class and discover something very interesting. The students' scores on their mid-terms and their finals are correlated, but the worst-performing students on the mid-term tended to show the greatest improvement between the mid-term and final. You conclude that they must have studied harder to make up for their poor mid-term grades. Is this conclusion valid? If there's another explanation, could you test to see which explains the pattern?

3.

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Coefficients:
                           Estimate Std. Error t value Pr(>|t|)
unemploymonthlycity       -0.010170   0.003846  -2.645  0.00859 **
logcensus2000pop           0.010036   0.009862   1.018  0.30965
census2000hispanicpercent  0.063919   0.055269   1.157  0.24836
census2000blackpercent    -0.032221   0.059074  -0.545  0.58585
census2000bachdegplus     -0.130272   0.153069  -0.851  0.39538
census2000medhomevalue    -0.001807   0.001096  -1.649  0.10022
census1990medhhinc         0.001662   0.001526   1.089  0.27709
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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1265 on 312 degrees of freedom
  (923 observations deleted due to missingness)
Multiple R-squared(full model): 0.1186    Adjusted R-squared: 0.03952
Multiple R-squared(proj model): 0.05052   Adjusted R-squared: -0.03469
F-statistic(full model):  1.5 on 28 and 312 DF, p-value: 0.05363
F-statistic(proj model): 2.372 on 7 and 312 DF, p-value: 0.02248
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Imagine that you wanted to examine the effect of unemployment on mayoral elections. The regression output above shows the relationship between city-level unemployment and the vote share of incumbent mayors running for re-election. The sample is elections in several large cities in the United States with incumbents running, with most cities observed multiple times. The dependent variable is incumbent vote

share. The main independent variable is the unemployment rate in each city in the month of the election. Besides fixed effects for each year (not shown), control variables include:

- Percent Hispanic in the 2000 Census
- Percent Black in the 2000 Census
- Percent with a college education (bachelors' degree) in the 2000 Census
- Median Home Value in the 2000 Census
- Median income in the 1990 Census

a. What is the 95% confidence interval for the effect of unemployment on incumbent vote share?
b. Is the difference between the effect of Hispanics (*census2000hispanicpercent*) and education (*census2000bachdegplus*) on incumbent vote share statistically significant? (Assume that the covariance between the coefficients for percent Hispanic and education is zero.)

Imagine that you receive reviews back for this paper.

c. Reviewer 1 argues that there are issues with how the sample is defined in this study. Do you agree? If so, what are the potential problems?
d. Reviewer 2 argues there are issues with the main independent variable (unemployment) and control variables in the model. Do you agree? If so, what are the potential problems?
e. Reviewer 3 raises concerns about the causal identification strategy in this regression. Evaluate the causal identification strategy in this model. Could the identification strategy be improved? If so, how?
f. The editor suggests including a control variable with the percentage of non-Black and non-Hispanic in the 2000 census to provide a "full list." Does this approach make sense? Why?

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Coefficients:
                                      Estimate Std. Error t value Pr(>|t|)
unemploymonthlycity                   -0.0054583  0.0104076  -0.524   0.6009
dailypaper2                            0.0450385  0.0751546   0.599   0.5501
logcensus2000pop                      -0.0004076  0.0181860  -0.022   0.9822
census2000hispanicpercent              0.1112556  0.0862942   1.289   0.1998
census2000blackpercent                -0.0171188  0.0925319  -0.185   0.8535
census2000bachdegplus                  0.0061385  0.2295642   0.027   0.9787
census2000medhomevalue                -0.0033221  0.0015468  -2.148   0.0337 *
census1990medhhinc                     0.0008549  0.0025406   0.336   0.7371
unemploymonthlycity:dailypaper2       -0.0080569  0.0096777  -0.833   0.4068
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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1156 on 120 degrees of freedom
  (1114 observations deleted due to missingness)
Multiple R-squared(full model): 0.233   Adjusted R-squared: 0.04759
Multiple R-squared(proj model): 0.1178  Adjusted R-squared: -0.09542
F-statistic(full model):1.257 on 29 and 120 DF, p-value: 0.1962
F-statistic(proj model):  1.78 on 9 and 120 DF, p-value: 0.07885
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Your paper also examines whether the local media affects accountability for the economy. One specification in the paper (above) focuses on how the presence of a local newspaper affects the link between unemployment and the incumbent's vote share by adding a local newspaper variable and an interaction between this variable and unemployment (the last variable).

g. Putting aside issues of statistical significance, how should we interpret the interactive effect in this model for the effect of a local paper? It might be useful to write out an equation.

h. What is the estimated difference in vote share for a city with 5% unemployment and no local paper versus 8% unemployment with a local paper?

i. Reviewer 4 comments that the non-significant results for the main variables and interaction term imply that unemployment doesn't matter after all. How would you respond to this?

j. Suppose you adjusted this model to replace *unemploymonthlycity* with an interaction between *unemploymonthlycity* and a dummy variable for *no* local paper. All other variables remain the same. Would this be a valid regression? What would be the resulting coefficients for this variable and the other interaction term?

Part II

1. Network analysis includes, among other things, a set of measurement tools. Give examples of two of these tools. Explain the theoretical basis for these tools, what advantages they have over more conventional measurement tools, and their limitations. For each tool, give an example of how one might use it in applied research, including an explanation of why it would be useful in this context and how it can improve our inferences.

2. Because of attrition or survey item non-response, experimental studies often have missing outcomes for some subjects/units. What are the potential consequences of this situation? What might you do to assess the severity of the problem? What strategies can you use to account for this issue in your analysis and what are their strengths and limitations?

3. Political scientists are often interested in testing causal mechanisms. What are some of the ways in which political scientists test hypotheses related to causal mechanisms and what are their strengths and limitations? If you were going to design an experiment that was mainly concerned with testing different potential causal mechanisms, what would you do?

4. You have been asked to review a paper investigating the impact of economic growth on civil conflict. The authors use rainfall shocks (which can impact economic growth in an agricultural society) as an instrumental variable. What is an instrumental variable and why are the authors using it in this case? What are the core assumptions and criteria that must be met for a potential instrumental variable to be valid? Thinking about the rainfall/economic growth example, how would you go about evaluating the plausibility of these assumptions in this case?

5. The basic idea behind a regression discontinuity design (RDD) is that assignment to treatment is determined, either completely or probabilistically, by whether a forcing variable is on either side of a fixed threshold. RDD estimates the local average treatment effect, approximating a randomized experiment at the threshold. What are the key assumptions to draw causal inferences using a regression discontinuity design and how are they best justified? Describe an example where scholars might use an RDD but the assumptions are *unlikely* to be satisfied.

6. Many observers have commented on the problem that empirical researchers have many plausible options when setting up an empirical study, which Andrew Gelman calls "the garden of forking paths." As a result, this freedom allows researchers to pick options to produce their desired results. How important an issue do you think this is for empirical research? Is it better or worse

for particular kinds of research? Describe three ways that scholars can improve empirical practice to guard against this potential problem and/or reassure evaluators about their findings.

Game Theory: Counts as two questions

Consider an activist who wants a dictator to implement a political reform. The activist comes in three types: Radical, Moderate, and Quiet. The dictator's prior beliefs over these types are given by q_R, q_M, and $q_Q = 1 - q_R - q_M$. The order of the game is as follows:
1. The activist chooses to protest or not at cost c.
2. The dictator implements the reform or not.
3. The activist chooses to launch a revolution or not, at cost d to both players and with likelihood of success p.

The payoffs are such that Radical types will revolt no matter what. Quiet types will never revolt, but prefer getting the reform. Moderate types will revolt if and only if the reform is *not* granted (i.e., the reform satisfies them). Implementing the reform costs the dictator 1, with $d > 1$. The dictator also gets benefit W from ruling and 0 otherwise. If a revolution is attempted, the activist's payoff does not depend on whether the reform was granted (since they'll either be in charge or in jail), but assume the dictator still loses 1 by granting the reform.

(a) What is the total payoff to the dictator if they do not reform and face revolt? What is the total payoff to the dictator if they reform and avoid revolt?

(b) After seeing step 1, the dictator will update their beliefs on the type they are facing. Call the updated beliefs in step 2 q'_R, q'_M, and q'_Q. For what set of updated beliefs will the dictator implement the reform in step 2?

(c) What are the conditions for each type of activist to protest in step 1?

(d) Using (b) and (c), under what conditions is there a separating equilibrium? (This includes cases where two of the three types overlap, but the third does something different.)

(e) In the separating equilibrium, what is the probability that reform occurs (assuming the dictator's initial beliefs give the correct probabilities of each type)? What is the probability of revolt?

(f) How does the structure of signaling in step 1 and/or payoffs for the activist types need to change to get an equilibrium that is maximally beneficial for the dictator?