PROBLEM SET 4

**Due on Monday, April 15, 2024**

I - INSTRUCTIONS

To successfully complete this problem set, please follow these steps:

1. Download this Word document file into your computer and download the datasets into a data subfolder in your problem set-specific Stata Project or RStudio directory.
2. Insert your answers into this document and organize your code in a Stata or R script. You can also insert non-Word objects such as handwritten work or screenshots in your answers.
3. Once your document is complete, please save it as a PDF.
4. Please submit an electronic copy of the **PDF** and your **replicable Stata or R script** to the Canvas assignment page.

II - IDENTIFICATION

1. Your information

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| Your Last Name: Boochever |  |
| Your First Name: Oscar |  |

(2) Group Members (please list the classmates you worked with on this problem set):

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| *N/A* |

1. Compliance with Harvard Kennedy School Academic Code[[1]](#footnote-1) (mark with an X below)

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| |  |  |  | | --- | --- | --- | |  | **Yes** | **No** | | I certify that my work in this problem set complies with the Harvard Kennedy School Academic Code | X |  | |

For this problem set, we will be examining the following paper:

Stevenson, Betsey, and Justin Wolfers. 2006. "Bargaining in the Shadow of the Law: Divorce Laws and Family Distress," *Quarterly Journal of Economics,* 121 (1): 267-88.

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| **Tips:** Forthis problem set, you may find it more efficient to go back and forth between the conceptual and data analysis questions, as many questions are paired.  **Instructions:** Please keep your answers *concise*. Most sub-questions can be answered in 1-2 sentences. Bolding or italicizing keywords also help grading. |

# Conceptual Questions (35 points)

1. Read the paper.
   1. Clearly state the primary research question that the authors are trying to answer. (2 points)

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* 1. In 2-3 sentences, explain the main finding of the paper using non-technical jargon, as if you were writing a brief policy memo. (2 points)

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* 1. What are the two channels through which unilateral divorce laws may have reduced suicide rates among married women? (2 points)

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1. The authors used a difference-in-differences (DID) design because they believed a comparison between state-years with and without unilateral divorce to be lacking. What are two possible confounders that would bias the results from a simple comparison and are hard to measure? Explain the mechanism of the omitted variable and use the omitted variable bias formula to argue whether it would lead to an understatement or overstatement of the true effect. (3 points)

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1. The authors’ main regression is:

A picture containing knife

Description automatically generated

What kind of regression specification is this? Explain each term in the regression. How should we interpret the coefficients? (3 points)

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1. What does the parallel trends assumption claim in this specific context? Why or why not do you think it is reasonable? Explain this in a way that someone not well-versed in statistics would understand. (2 points)

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1. How would you estimate standard errors in this setting and why? (Note that the correct way to cluster is different from what the authors report). (2 points)

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1. The authors use the suicide rate for *all* women, not just those who have been married, “to avoid endogeneity problems posed by the possibility that marriage decisions may respond to divorce regime.” Give one example of such an endogeneity problem. How would it bias the results? (2 points)

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1. Comment on how the effect of unilateral divorce laws on *male* suicide differs from the effect on female suicide. Given the difference in baseline suicide rates for men and women, would you expect the elasticity of male suicide to be different from the elasticity of female suicide? (2 points)

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1. Give two ways that Figure I increases the credibility of the results presented in Table I. Would you change anything about how Figure I is presented? (3 points)

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1. The authors present DID estimates of the effect of unilateral divorce laws on domestic violence in Table II. The first row presents the results from a simple DID and the next three rows sequentially add controls to address concerns about bias.
   1. Identify and interpret the treatment effect estimated by the main DID estimate in column 1 of Table II. (2 points)

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* 1. What is one potential source of bias in the DID that would be eliminated by the addition of state-level time-varying controls? (1 point)

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* 1. What is one potential source bias in the DID that remains even after adding all the controls listed in Table II (state fixed effects, individual controls, and state-level time-varying controls)? (1 point)

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1. The authors present estimates of the effect of unilateral divorce laws on intimate homicide in Table III. What is the regression specification they run in columns 1 and 2 (Hint: Read the note to Table III)? Note that this is a staggered treatment design. Describe how this estimator relates to a simple DID estimator. (2 points)

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1. Figure II plots an event study of the effect of unilateral divorce laws on intimate homicide.
   1. What concerns does this figure raise? (1 point)

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* 1. How does the triple-difference (reported in column 4 of Table III) address some of these concerns? (1 point)

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* 1. Write down a regression equation to estimate the triple-difference results in Table III and indicate the coefficient of interest. (2 points)

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1. What is a specific example of a potential threat to a) internal validity and b) external validity in this study? (2 points)

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# Data Analysis Questions (37 points + 1 extra point)

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| For this problem set, you can rely on a two-part demo: [constructing variables for DID](https://vimeo.com/409267138), and [estimating DID coefficients](https://vimeo.com/409267190) with the two-way fixed effects estimator. That said, the techniques involved (e.g. fixed effects) are not new. A data appendix below describes the dataset and the key variables. |

In this section, we will estimate the effect of unilateral divorce laws on female suicide. In the problem set link, we have provided a lightly cleaned version of their main analysis files: stevenson\_wolfers\_210.dta. The data we are using is available from [Justin Wolfers’ website](http://users.nber.org/~jwolfers/).

The data for this problem set is a state-by-year panel. Observations are uniquely identified by state, year, and sex. The data has the following key variables:

* st and year are the state and year variables.
* sex indicates whether the outcome is observed for males or females. It is coded as 1 for males and 2 for females.
* divyear is the year of unilateral divorce reform. It is coded as 1950 if the state always had unilateral divorce laws and 2000 if unilateral divorce reform was never passed.
* unilateral indicates whether unilateral divorce is legal.
* suiciderate\_jag is the suicide rate.

1. We will begin by estimating a simple 2x2 difference-in-differences regression.
   1. The year in which the greatest number of states passed unilateral divorce laws was 1973. Using data on states that passed unilateral divorce laws in 1973 and those that never passed unilateral divorce laws, run a simple 2x2 DID regression to estimate the effect of unilateral divorce laws on ln(suiciderate\_jag) for women, clustering standard errors at the state level. Report the estimated DID effect and the standard error below. (4 points)

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* 1. Interpret the point estimate. Explain which treatment/control groups are being compared and how the effect is estimated so that someone without statistical training could understand. (3 points)

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* 1. Are the results significant? Can you rule out substantively meaningful effect sizes? (1 point)

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1. Now we will assess whether the parallel trends assumption is reasonable in this setting by estimating an event study, pooling data from all the states.  
   1. Consider the following event study regression specification:

Interpret the coefficients. (2 points)

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* 1. Plot the event study, being sure to include confidence bands as well as point estimates (Hint: Follow Andrew Goodman-Bacon’s mini-guide [here](https://twitter.com/agoodmanbacon/status/1165643395844493313)). (4 points)

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* 1. Interpret the figure. Does it support the parallel trends assumption? How do the effects of the reform appear to unfold over time? (2 points)

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* 1. Read the abstract and introduction of Rambachan and Roth (2023), “A More Credible Approach to Parallel Trends.” Explain the potential concerns with using the above event study regression estimates to assess the parallel trends assumptions. (3 points)  
       
     Bonus: Read the introduction of Sun and Abraham (2020) and explain the concern with event studies when there is staggered timing in treatment adoption. (1 extra point)

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1. Now estimate the pooled DID effect using a two-way fixed-effects regression specification.
   1. Report the coefficient and standard error clustered at the state level. How does the point estimate compare to the simple 2x2 estimate from question 13? How do the standard errors compare? (2 points)

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* 1. How should we think about the two-way fixed-effects estimate? What comparisons are being made? How many are there? Categorize these comparisons into four distinct groups. (4 points)

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* 1. Given the event study you estimated in question 14, what concerns might you have about some of these comparisons? Do you think the two-way fixed-effects estimate may be biased? If so, in what direction? (3 points)

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1. Use the bacondecomp command to decompose the two-way fixed-effects estimate into a weighted average of 2x2 DID effects and visualize the estimates against the weights.  
   1. Which kinds of comparisons get the most weight in the two-way fixed-effects estimate? (2 points)

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* 1. Are the results of the decomposition consistent with any concerns you had about bias in the estimate? (1 point)

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* 1. Use the results of the decomposition to estimate a pooled DID that omits 2x2 comparisons in which the post-reform period of early reform states serves as the control group for states that passed unilateral divorce laws later (the forbidden comparison). (2 points)

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1. Run a regression specification that does not use the post-reform period of the early reform states as a control group for states that passed unilateral divorce laws later. To do so, create a separate dataset for each reform group (e.g., states that passed unilateral divorce laws in 1973) that excludes earlier reform groups and excludes the post-reform period for later reform groups. Stack these datasets into a single dataset and estimate a two-way-fixed-effects regression that interacts year fixed effects with dataset fixed effects. Report the coefficient and standard error below. Comment on how and why it differs from the regular two-way fixed effects regression. (4 points)

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# DIDs in Your Own Work (14 points)

1. Drawing from your own experience and interests, suggest a question that you might try to answer using a difference-in-differences model. As you think through what this would entail, explain the following aspects of your proposed analysis:
   1. Propose a specific policy question. Explain why you think this is an interesting and important policy question. Provide evidence that there is ***not*** already a conclusive answer to this question. (2 points)

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* 1. Describe your treatment group. (1 point)

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* 1. Propose a comparison group and explain why you chose that group. In your answer, make sure to explain what the parallel trends assumption would mean for your analysis and whether you think that assumption will be satisfied. (2 points)

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* 1. Describe the fixed effects that you would use in your difference-in-differences specification. (1 point)

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* 1. Describe how you would cluster your standard errors, if at all. (1 point)

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* 1. Provide three examples of confounding issues that would be addressed by using the fixed effects that you include. (3 points)

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* 1. Provide three examples of additional issues that might still bias your estimates despite using a difference-in-differences specification. How might you consider addressing those issues? (4 points)

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**Reminder: please include your replicable separately in your submission.**

1. We abide by the Harvard Kennedy School Academic [code](https://www.hks.harvard.edu/educational-programs/academic-calendars-policies/student-handbook/general-regulations-and-1) for all aspects of the course. In terms of problem sets, unless explicitly written otherwise, the norms are the following: You are free (and encouraged) to discuss problem sets with your classmates. However, you must hand in your own unique written work and code in all cases. Any copy/paste of another’s work is plagiarism. In other words, you can work with your classmate(s), sitting side-by-side and going through the problem set question-by-question, but you must each type your own answers and your own code. For more details, please see syllabus. [↑](#footnote-ref-1)