UNIVERSITY OF BAYREUTH

Causal Inference Spring 24

Take-Home Exam

Due on 20 August at Noon
Word limit: 7000 words

Part A

Exercise 1: Variation & Counterfactuals

In your own words, describe the counterfactual for the potential outcomes of the treatment group that allows you to estimate the treatment effect between the treated and control groups in the following research designs. (You are welcome to use hypothetical empirical examples if you like, but you are not required):

1. Time *and* unit fixed effects in panel data.
2. Exact matching using three covariates in cross sectional data.
3. Difference-in-differences estimator in panel data.
4. Sharp Regression Discontinuity Design LATE estimator.

Exercise 2: Identification & SUTVA

The Syrian civil war that began March 2011 has led to one of the largest refugee and displacement crisis of our time, affecting millions of people and spilling into surrounding countries. Since 2011, Sweden welcomed around 150,000 Syrian refugees and randomly allocated them across a share of their local councils. Researchers would like to evaluate whether this random influx of refugees has led to voting for extreme right candidates in recent local elections. Evaluate the SUTVA in this context.

Exercise 3: Assumptions & Research Design

In a recent but quite influential study, Ferwerda and Miller examine the effect of the Nazi administration rule on resistance. They use a Regression Discontinuity Design, based on the Vichy line: the line that was used to separate land occupied by Nazi Germany with the Vichy-governed French zone. Their findings lead them to conclude that devolving governing authority significantly lowered levels of resistance: there are fewer resistance incidents in the Vichy area than in the Nazi occupied area, to the north of the line.

This finding has been recently questioned by Kocher and Monteiro, who criticize the Ferwerda and Miller study on various methodological grounds. Ferwerda and Miller subsequently responded to these criticisms.

Carefully read the debate around these studies and answer the following questions:

1. What is the main criticism by Kocher and Monteiro with regard to the utility of the Vichy line as an identification tool in this context? Use potential outcomes terminology and refer to the RD assumption in your answer.
2. What tests do Ferwerda and Miller implement to address this criticism?
3. Having read both sides, do you believe or do you question the evidence provided by Ferwerda and Miller?
4. Briefly elaborate on the general utility of the RD in this context and on the potential sources of caution that one might need to have in mind when implementing this method for geographic/political boundaries.

Exercise 4: Identifying a Cause - Rewards or Competence?

A voluminous literature uses natural disasters or other events to examine the extent to which incumbents are rewarded for their performance in delivering services to their constituents (Wolfinger and Rosenstone 1980; Mettler and Stonecash 2008; Bechtel and Hainmueller 2011). What remains unclear in these cases is whether voters reward incumbents' post-disaster efforts because they are grateful (similar to how voters might act when directly bribed by politicians) or because the politician's disaster

response reveals to them that the politician has higher competence than they thought. To address this question, one could look at an instance of a natural disaster in which the incumbent did not perform well, but did financially reimburse the affected areas.

One such example is the *Prestige* accident that took place in late 2002 in the Galician coast, in Spain. The accident led to the severe pollution of the Spanish north coast. Although the government failed to manage the crisis, it generously reimbursed the residents of the affected areas. Here comes a quick chronicle of the events:

On 13 November 2002, the Bahamas-registered oil tanker *Prestige*, laden with 77,000 tonnes of heavy fuel oil, broke in two off the Galician coast (Spain) spilling an unknown but substantial quantity of its cargo. Although the accident occurred within 5 miles of the Galiza, the Spanish national government (in the hands of the Conservative Popular Party [PP]) refused it safe harbour, instead sending it away from shore in a north-western direction. This was the first in a series of decisions that later provoked on November 19 the sinking of the ship 150 miles off the coast and the biggest oil spill, in terms of affected area, since the Exxon-Valdez accident (note that the entire Spanish northern Atlantic coast was affected as well as some Portuguese and French coastline). Pristine ecosystems were harmed, and all fishing and seafood collection - which are important industries in Galicia - were forbidden for months along the 1,390 km Galician coast. Figure 1 presents the geographical area that was affected by the accident.

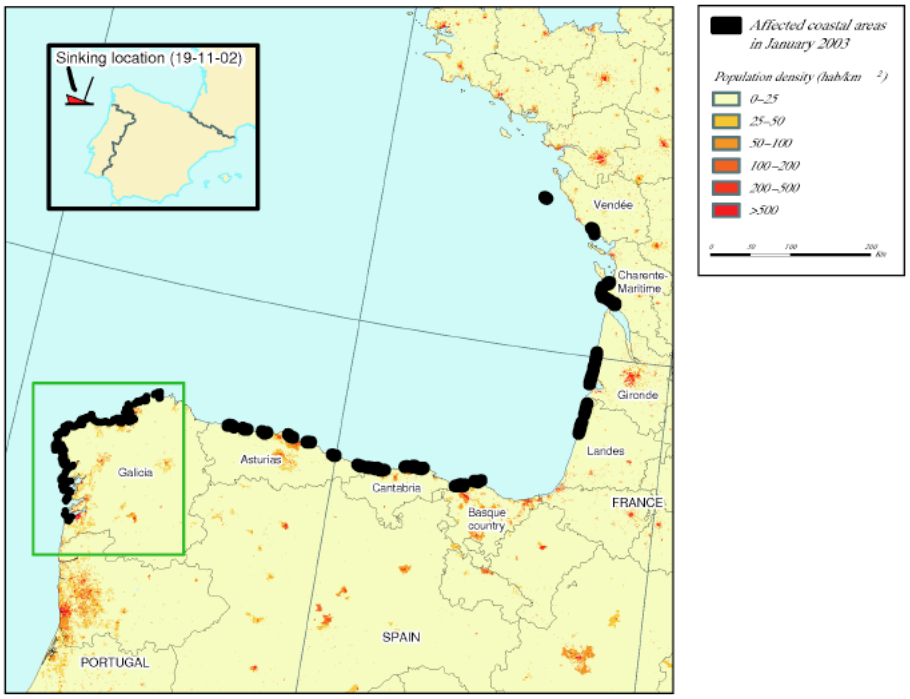
The Prestige oil spill occurred only about six months prior to the 2003 regional and local elections and was without any doubt the most devastating natural disaster in Spain in over 25 years of democracy. Some opposition political parties (e.g., the Galician Nationalist Party [BNG], United Left [IU], and the Socialist Party [PSOE]) presented the decision of taking the ship far from the Spanish coast as a political one, revealing the "incompetence" of the ruling party in Madrid, and as evidence of the small weight attached by the central government to Galician issues. More broadly, it provided future Prime Minister Rodriguez Zapatero and the main opposition party—the Socialist Party (PSOE)—with a key opportunity to win over voters and improve their performance in the upcoming election. In fact, one Socialist MP in the regional assembly of Madrid had to resign when one radio station made public that the deputy believed that the PSOE was "overrun" of voters after the disaster and he subsequently joked about the convenience of "sinking another boat, if necessary."[1]

[1] The political controversy generated around the issue did also give birth to a grassroots popular movement (the so-called, *Plataforma Nunca Máis)* that sought to fight against the most negative consequences of the accident at the environmental level, to blame the national (and the regional) incumbents for their bad performance during the catastrophe, and to avoid the occurrence of similar situations in the future.

Yet, this is only part of the story. In response to the spill, the Galician *regional* government - also in hands of the PP - launched a huge relief program that included the abundant allocation of rapid and massive transfers of aid to citizens in affected areas (the 'Plan Galicia'). The first payments went out two months later. These funds were seen as particularly suitable given the fact that the major economic benefit of Galicia is its fishing industry. To sum up, two features characterise the Prestige oil spill: a disastrous management of the sinking, but an extraordinary relief action by the government. How did voters react to this? How did they solve the task of weighting up two contradictory inputs?

The 2003 Spanish municipal elections took place in all 8,108 municipalities throughout the country. Your interest lies in those municipalities that were affected by the accident (henceforth dubbed *Prestige*). Since the oil spread throughout the coast, it is extremely difficult to have precise estimates about the extent of damage incurred in each municipality. One solution could be to denote as affected all the coastal municipalities of the region ($n = 56$). Other solutions can also be suggested. Figure 1 presents the treated municipalities located in the coast of Galicia. Note that other parts of the Spanish coast were affected, too.

Figure 1: Affected Coastal Areas



Your task is to develop a brief research design aimed at isolating the effect of *Prestige* on the vote share of the incumbent party. Make sure to include the following information:

1. A clear definition of your unit of analysis as well as treatment and control groups.
2. The identification assumption of your estimation strategy and how you want to examine whether it holds or not.
3. Does you research design allow you to isolate the effect of the two channels (the effect of the incumbent's response to the disaster and the effect of the transfers of aid)? If yes, describe how so.
4. The potential limitations of your research design.

Part B

Exercise 5: Insurgents and (Civil) Wars

A key problem incumbents encounter in civil wars is lack of information to combat insurgency. Given that insurgents exploit information asymmetries at the local level, they can easily hide and become a difficult target for incumbents. In the absence of such information, incumbents often resort to indiscriminate violence, via large-scale reprisals against entire villages suspected to host insurgents. One such example of indiscriminate violence is Aerial bombardment. Due to the nature of insurgency, bombing frequently occurs in and around settled areas, and consequently it tends to generate many civilian casualties. Using data from the Vietnam War, Kocher, Pepinsky and Kalyvas examine the effect of such bombings on Viet Cong support. In particular, they look at the impact of September 1969 bombings on hamlet control in December 1969.

The data comes from various sources. The United States compiled a gazetteer of South Vietnamese hamlets, identified their geographic coordinates, and conducted a census. District Senior Advisors (DSAs), Army officers ranking major or above, were assigned to complete detailed questionnaires, some on a monthly basis, others quarterly, for every village and hamlet in their zones of operation. DSAs, together with small American staffs, were detached from U.S. units to live and work in the districts they rated. The Republic of Viet Nam had 261 districts with a median area of 377 kilometres squared, or about one-fourth the size of the median U.S. county. There was a median of 36 hamlets

per district in 1969. One might analogize the problem a DSA faced to that of the sheriff of a small U.S. county trying to identify dangerous towns or neighborhoods in his or her jurisdiction. Linking bombings to hamlets, the authors construct a dataset that allows them within some margin of error to identify the number of bombings per hamlet in September 1969 and examine their impact on insurgency control. The variables of interest are as follows:

- `mod2a_1adec`: the "Enemy Military Model (2A)" (Hamlet Control) in December 1969, which rates the presence and activity of Viet Cong military units in the vicinity of each hamlet on a 5-point scale:"fully government controlled" (1), "moderately government controlled" (2), "contested" (3), "moderately insurgent controlled" (4), and "fully insurgent controlled. While an ordinal variable, consider this variable to be continuous for the purposes of this exam.
- `bombed_969`: Number of bombings per hamlet in September 1969.
- `std`: Rough terrain
- `lnhpop`: log of hamlet population
- `ln_dist`: log distance from closest international boundary
- `score`: Development index score
- `mod2a_1ajul`: Enemy Military Model (2A) in July 1969
- `mod2a_1admn`: District average control before September 1969

Your task is as follows:

1. Use a matching estimator to derive the effect of September bombing in September 1969 on insurgency control in December 1969. Choose matching estimator other than Caliper matching, but describe how you have chosen the estimator and upon which assumptions it rests. To conduct the analysis, operationalise the treatment as a binary variable. Discuss which covariates you use in the matching procedure and why.
2. Assess balance in pre-treatment covariates between treated and control units, before and after matching.
3. Use Capiler matching using a capiler of 0.25 and estimate the treatment effect. Assess balance before and after Caliper balancing between the control group and the treated group. Is Caliper

matching doing a better job than the algorithm you chose in the previous question? Which matching procedure do you prefer and why?

4. Estimate the effect of the number of bombings in September 1969 on hamlet control in December 1969 using a multivariate regression by conditioning on covariates. Discuss which covariates from the dataset you have included and why. Does the point estimate and standard error you estimate differ from the ones you have found in 4.3.? Discuss which result you find more convincing and why.

Analyses that rely on random number generators should include the following seed: set.seed(02024024).

Exercise 6: Institutions and Economic Development

This task is based on the famous Acemoglu, Johnson & Robinson (AJR) 2001 study on the importance of inclusive institutions on economic development.[2] AJR argue that institutions leave a long imprint on countries' economic activity. They distinguish between inclusive and extractive institutions. The former serve to diffuse economic returns along different strata, whereas the latter serve to appropriate wealth among few.

To find evidence for the importance of the distinction between good and bad institutions, they turn to the colonial structures of the 19th and early 20th century. Their identification strategy comes from the quasi-random variation in geography which determined whether colonizers would establish inclusive or extractive institutions. In those areas in which settlers encountered high mortality rates they built extractive institutions, without long-term planning. In areas with low mortality rates, they built inclusive institutions. To the extent that the geographic determinants of mortality rates are as good as randomly assigned, they provide a very important instrument in order to test the economic returns of institutions.

The data can be found on the website as `AJR.dta`. The key variables are the following:

- `logpgp95`: the logged GDP per capita measured in 1995. (Logging GDP is a very typical way to bring its distribution closer to the normal, while changing the interpretation from levels to percentages – if you have more questions about what logarithmic transformations do and how they are interpreted, please ask me). This is Y, the dependent variable of interest.

[2] Acemoglu, Johnson, & Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review*, 91(5): 1369-1401, available here.

- `avexpr`: Average protection against expropriation risk (1985—1995). This is an index of how extractive a given set of institutions is. This is our D, which is of course not randomly assigned.
- `logem4`: Logged settler mortality rates. This is Z, our instrument.

You can also use other variables from the dataset if you think this helps in any part of your analysis. Your tasks are to answer the following questions:

- Is there a link between institutions and economic development? This is not a causal question, I'm just asking if there is any association between the two. Provide a scatterplot to show this is the case.
- Is this relationship causal? How do mortality rates help in answering this question?
- Provide a graph for the reduced form equation. Estimate the ITT.
- Is the first-stage assumption valid in this example?
- Estimate the LATE, using both an - emulated - Wald estimator and a 2SLS estimator. Does conditioning on observables change the estimates?
- After presenting their main results, the authors try to address criticisms about the validity of the instrument (practically about exclusion). Read that section of the paper (available here). Now evaluate the exclusion restriction: Do you conclude the authors' IV design is valid? Why or why not?

Exercise 7: The Number of Candidates and Political Representation

In the aftermath of the 2016 US Presidential election, Jill Stein, the defeated candidate of the Green party, said in an interview that turnout would have been lower if she had not competed. When asked about the possibility that her candidacy contributed to the defeat of Hilary Clinton, Stein claimed that her supporters would have abstained if they could not have voted for her. This general intuition is shared by many: in countries in which political competition revolves around a few candidates like in the United States, the United Kingdom, or Canada, people whose preferences do not resonate with any of the candidates are more likely to abstain because they feel *alienated* by the system (for a review

of the literature, see Blais, 2006). This is a strong case in favor of elections with more than two candidates, and flexible state regulation facilitating candidacy, as a way to increase turnout and reduce inequalities in political representation (Gallego, 2014).

Several comparative and cross-sectional studies have investigated this question, but with mixed results: some find that the number of candidates decreases turnout (e.g. Jackman, 1987), some that it increases it (e.g. Taagepera et al, 2013), and yet others that it has no effect (e.g., Fornos et al, 2004).

Question a) Discuss why cross-sectional studies across countries **or** across regions within a given country could lead to mixed results. What type of selection bias could be present in the country cross-sectional studies and what type of selection bias could be present in within country regional cross-sectional studies? Write out a model specification you imagine they estimate and discuss sources of omitted variables bias using formal notation.

Question b) You learn that France has an interesting twist to their electoral rules on how many candidates run in legislative and cantonal elections. Legislative and cantonal elections in France are held under a two-round majority system. **The second round is held one week following the first one. The two candidates with the largest number of votes in the first round are automatically qualified to the second round. Yet, if another candidate receives a vote share higher than the qualifying threshold, they also qualify to the second round.** Importantly, the vote share for this threshold is calculated out of the number of registered voters. For legislative elections, the qualifying threshold is 12.5%. In cantonal elections, it is 10%, except in 2011 for which it was 12.5%. You also obtain official results of all French legislative and cantonal elections between 1978 and 2012, including close to 14,000 electoral district races. If a candidate receives a number of votes larger than 50% of the total number of valid votes in the first round, and if this number is higher than 25% of the total registered voters in the district, they are elected and there is no second round. These elections are excluded from this data set. The dataset, `france.dta`, is available on the course website (see the last page for variable descriptions. Do appraoch me if you have any questions about this).

1. As a first step, you should get to know the data: i) What is the unit of observation (a row) in

the dataset? ii) What types of elections are covered in the data? iii) How many candidates are there in the first and second round on average? iv) What is the average turnout and null and blank votes in the second round if there are two candidates vs three candidates? What would you conclude from that? v) How many third ranked candidates in the first round pass the qualifying threshold? How many of those run in the second round? (*Hint: Use the variables threshold and threshold_party_can3.)*

2. What causal inference method would you use to study this question? Write out the model specification and discuss what the identification assumption is in this case.

3. Produce at least one (descriptive) plot and discuss what this plot tells you about the data in the context of your research strategy.

4. How would you test the identification assumption? Choose at least one way using the data provided to empirically test that your choice of the research design is internally valid.

5. Estimate the effect of a third candidate by estimating the first and second stage on the two main outcomes: voter turnout & null and blank votes. Operationalise the main outcome variables and the running variable as you see appropriate. Interpret the results, both in terms of the size of the estimates in the first and second stages and their statistical significance.

variable name	type	format	label	variable label
year	int	%10.0g		
id_canton	byte	%8.0g		
departement	str29	%29s		
election	str8	%9s		**type of election**
party_can1	str14	%14s		**party of first ranked candidate**
voteshare_t1_~1	long	%8.0g		**total votes in round 1 of first ranked candidate**
voteshare_t2_~1	long	%10.0g		**total votes in round 2 of first ranked candidate**
ran_t2_can1	float	%9.0g		**whether first ranked candidate ran in round 2**
ideology_can1	float	%9.0g		**ideology of first ranked candidated**
party_can2	str14	%14s		**party of second ranked candidate**
voteshare_t1_~2	long	%8.0g		**total votes in round 1 of second ranked candidate**
voteshare_t2_~2	long	%10.0g		**total votes in round 2 of second ranked candidate**
ran_t2_can2	float	%9.0g		**whether second ranked candidate ran in round 2**
ideology_can2	float	%9.0g		**ideology of second ranked candidated**
party_can3	str14	%14s		**party of third ranked candidate**
voteshare_t1_~3	long	%8.0g		**total votes in round 1 of third ranked candidate**
voteshare_t2_~3	long	%10.0g		**total votes in round 2 of third ranked candidate**
threshold_par~3	float	%9.0g		**qualifying share (votes/registered voters) for third candidate in first round**
ran_t2_can3	float	%9.0g		**whether third ranked candidate ran in round 2**
ideology_can3	float	%9.0g		**ideology of third ranked candidated**
inscrits_t1	long	%12.0g		**Registered voters, 1st round**
parties_t1	float	%9.0g		**Number of candidates, 1st round**
elected_t1	float	%9.0g		**Elected in first round**
parties_t2	float	%9.0g		**Number of candidates, 2nd round**
threshold	float	%9.0g		**qualifying threshold for third ranked candidate**
turnout_t1	float	%9.0g		**Turnout, 1st round**
cvotes_t1	float	%9.0g		**Valid Turnout, 1st round**
blancsnull_t1	float	%9.0g		**Null/Blank Votes, 1st round**
turnout_t2	float	%9.0g		**Turnout (2nd)**
cvotes_t2	float	%9.0g		**Valid Turnout (2nd)**
blancsnull_t2	float	%9.0g		**Null/Blank Votes (2nd)**
nosecond	float	%9.0g		**No second round, 3 criteria**
margin_t2	float	%9.0g		**Voteshare difference 1st-2nd cand**
margin_t1	float	%9.0g		**Voteshare difference 1st-2nd cand**
threecand	float	%9.0g		**Three candidates in second round**

Figure 2: Variables in the Data and their Labels