St Gallen Exam. This is due on August 10th, 2025 (I think!). Please email it to me at [scunning@gmail.com](mailto:scunning@gmail.com). I had a great time! It was wonderful meeting all of you and I wish you all the best of luck on your journeys, and hope you have fun this upcoming year. -scott

1. Using the variable *Y* to mean outcome, and *D* to mean treatment status, write down the 2x2 equation.
2. Using the switching equation and the 2x2 equation, write down what biases and the target parameter contained in each of the following scenarios. Secondly, what assumptions are required in order for the 2x2 to have a causal interpretation?
   1. Assume that the baseline is untreated (i.e., no anticipation or NA) and the comparison group is untreated in both periods.
   2. Assume NA and the comparison group is always treated.
   3. Assume NA and the comparison group was treated in the second period because of a “spillover” (i.e., “interference”).
3. Write down the *three* separate regression specifications that contain a calculation that is numerical identical to the 2x2.
4. Use the information in the “2x2” tab of the **spreadsheets.xls** file in our /st-gallen/labs subdirectory. Calculate the 2x2.
5. Now use the information in the “2xT” tab. There are two groups. Group 1 is treated in 2006 and remains treated until the end of the sample in 2010. Group 1 was not treated from 2001 to 2005. Group 2 was never treated for the duration of the panel. Y(1) is the potential outcome of the group if treated and Y(0) is the potential outcome if not treated.
   1. Mark in column G the pre-treatment and post-treatment periods.
   2. Mark in column F whether in that year the group is or is not treated with a 1 if treated, and a 0 if not treated.
   3. Use the switching equation formula in column E to select which potential outcome is observed in each year according to its treatment status.
   4. Calculate the ATT for group 1 in the post-period.
   5. Calculate the 2x2 for group 1. Is it a biased estimate of ATT?
   6. Calculate the non-parallel trends bias term using a 2x2 calculation and compare that answer to part 2e.
6. One of the advantages we gain from having more than 2 time periods is we can evaluate whether the two groups were trending similarly prior to treatment as measured by a 2x2 equation. But there are two ways to calculate a 2x2 pre-treatment coefficient. Calculate the 2003 2x2 using both methods.
7. Open the GxT spreadsheet. There are four groups each of which is named by the year in which they were treated. For instance, the 2001 group was treated in 2001, and so on. Each colored cell is the group-time ATT, or ATT(g,t), which is the correct measurement of the average effect of the treatment on that group in that year (compared to its own counterfactual). No Anticipation (NA) is verified by the fact that in this simulated data, the pre-treatment ATT(g,t) are all zero. Use the information in the spreadsheet to answer the following questions:
   1. **ALL CALCULATIONS**. Please answer the following questions for rows 32, 34, and 36 which I have called the “(All)” calculations.
      1. *Line 32:* Calculate the average ATT(g) for each group using *all* of the ATT(g,t) that exist. For instance, what is the ATT(g=2001) for the 2001 group? Do this for all four groups and interpret it in plain words.
      2. *Line 34:* Calculate the average group effect over those four ATT(g) averages. What weights were used for that calculation? Interpret this.
      3. *Line 36*: Calculate the *simple* average over all 72 ATT(g,t) parameters. What are its weights? Why is it not the same number as you found in line 34? Explain in plain terms what each one means and give an example where one may be more interesting to a policy-maker than another.[[1]](#footnote-1)
   2. **CS CALCULATIONS.** Please answer the following questions for rows 33, 35 and 37 which I have called the “(CS)” calculations named after Callaway and Sant’Anna (2021).
      1. In Callaway and Sant’Anna (2021), which of the ATT(g,t) parameters can be attempted and which ones cannot and why?
      2. Write down the assumptions needed for CS to identify each ATT(g,t) parameter successfully.
      3. *Line 33*: Write down the group-specific ATT(g) parameters that are feasible with CS.
      4. *Line 35*: Write down the group average over those feasible ATT(g) parameters from part *iii*. How does this number differ from part a from earlier?
      5. *Line 37*: Now calculate the simple average over all feasible ATT(g,t) parameters. What are the weights and why does this number differ from what you found in part a?
8. Now imagine someone wants to estimate the ATT using the following regression equation.   
     
   where tau and sigma are time and unit fixed effects, and *X* are the covariates needed to satisfy conditional parallel trends. What are the additional assumptions needed for to identify the ATT? Show your work.
9. Name the three alternatives to this specific regression specification that we discussed in class that will identify the ATT and their associated assumptions.

BONUS QUESTION **+5 points**

We said that one if not both of the Ignaz Semmelweis and the John Snow 2x2s may not be robust to heterogeneous treatment effects. Which one and why? Explain your reasoning.

1. I am going to accept almost anything that shows any thought when into your answer. [↑](#footnote-ref-1)