**Directions:** Today’s exercises together will be a series of applications using the baker dataset to implement TWFE, Callaway and Sant’anna, de Chaisemartin and d’Haultfoeille, Sun and Abraham, stacking, robust efficient imputation estimation and matrix completion. We will only be using the y variable, which is the variable that was generated with dynamic treatment effects.

**Static specifications**

1. **HAND.** Manually calculate the overall ATT by writing down in an excel spreadsheet the size of the ATT over time for each group. Answer the following.
   1. How many group-time ATT parameters are there?
   2. What is the overall ATT for each treatment group (1986, 1992, 1998 and 2004) if you use a uniform weight of 1/N?
   3. What is the overall ATT using a uniform weighting?
2. **TWFE.** Now estimate the overall ATT using the twoway fixed effects estimator. Write down your result and standard error in a table being sure to label the column to say TWFE.
3. **CS**. Estimate the overall ATT as well as the group-time ATTs and the group specific overall ATT using CS. Answer the following questions.
   1. How many group-time ATT parameters are there compared to your answer in 1a? Why is it different?
   2. How do your estimates of the overall ATT and the group-specific ATT compare to your answer in 1b and 1c? Why are they different?
4. **dCdH.** Repeat 3.
5. **Stacking**. Calculate the overall ATT using a stacking method.
6. **Robust efficient imputation estimation**. Repeat 3.
7. **Matrix completion**. Repeat 3.

**Dynamic specifications.** We will be using event\_

1. **Hand**. Manually calculate the following relative event time ATTs using a uniform weight for t-2, t-1, 0, t+1 and t+2 using the known treatment effects. Interpret each lead and lag parameter.
2. **TWFE**. Estimate the dynamic treatment effects, make a figure, but note the following:
   1. **Binning**. Because of differential timing, the data is not balanced in “relative event time”. The 2004 group has 5 lags, but the 1986 group has 23. Bin the data such that all post-treatment periods greater than 5 are grouped in one dummy, and same for leads. Drop two pre-treatment periods.
   2. **Trimming**. Repeat 9a, but this drop all observations for the t+5 and t-5 so that the data is “balanced in relative event time”.
3. **CS**. Estimate the dynamic treatment effects, make a figure. How do your t+2, t-1, 0, t+1 and t+2 leads and lags compare to 8?
4. **dCdH**. Estimate event study plots using dCdH.