

Empirical Project 3 The Effect of the U.S. EPA NO_x Budget Trading Program

Due at midnight (Pacific Time) on Friday, June 10, 2022

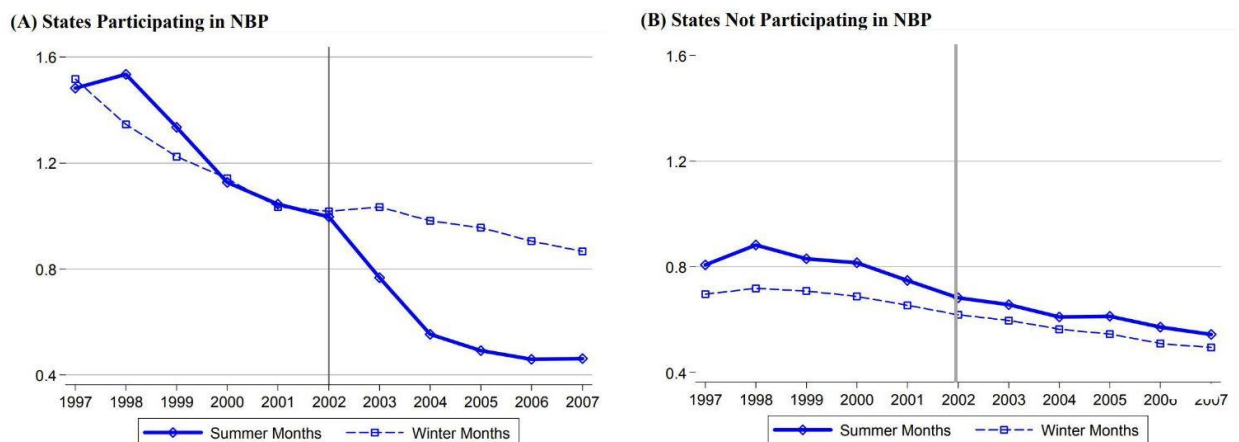
In this empirical project, you will use difference-in-differences and triple-difference designs to estimate the causal effect of the U.S. Environmental Protection Agency's NO_x Budget Trading Program (NBP) on air pollutant emissions. To answer some of the questions, you will need to refer to the following paper:

Deschênes, Olivier, Michael Greenstone, and Joseph S. Shapiro. "Defensive investments and the demand for air quality: Evidence from the NO_x budget program." American Economic Review 107, no. 10 (2017): 2958-89. (http://joseph-s-shapiro.com/research/NOx_Defenses_DGS.pdf); also available on Canvas: Files/reading/DGS_2017.pdf)

For the purpose of this Empirical Project, you may focus on the introduction (pages 1-5), Section I, Section III, Section IV, and Section V.A. of the paper.

The Stata data file **nbp.dta** consists of regulation and NO_x emissions data for 2,539 counties in the United States. Each observation represents a county*year*season (e.g., Summer 2008 of Lane County). These data were originally used in Deschenes, Greenstone, and Shapiro (DGS 2017). The medical expenditure and mortality variables used in the original paper are confidential and not available. For this empirical project, we will focus on the impact of the NBP on power plants' NO_x emissions. For the most part, we will replicate the following graph from DGS 2017, and produce the associated difference-in-differences, as well as triple-difference estimates.

Appendix Fig. 2 of the DGS 2017 Study



Note: Summer (solid line) vs Non-Summer (dash line) NO_x Emissions in NBP states (left panel) and non-NBP states (right panel). NBP came into effect in 2003.

Instructions

Please submit your Empirical Project on Canvas. Your submission should be a single PDF file containing three parts:

1. A 4-6 page summary (double spaced and including references, graphs, and tables)
2. A do-file with your STATA code or an .R script file with your R code
3. A log file of your STATA or R output

Specific questions to address in your summary

1. Briefly explain the policy variations induced by the NBP program.
Hint:
 - a. What does variable “nbp” = 1 indicate?
 - b. What does variable “summer” = 1 indicate?
 - c. What does variable “post = 1” indicate?
2. Replicate Panel A (States Participating in NBP) of the Appendix Fig. 2.
Hint: To obtain the solid line, compute year-over-year averages of “nox_emit” for all counties with “nbp”=1 and “summer”=1.
3. State the parallel trends assumption underlying Panel A of Appendix Fig. 2. Does the graphical pattern suggest the parallel trends assumption is likely to hold?
Hint: Which line (solid or dash) represents the “treatment group” and which line represents the “control group”?
4. Clearly state, estimate, and report a difference-in-differences regression that examines the effect of the NBP program on NOx emissions corresponding to Panel A of Appendix Fig. 2. Provide a one-sentence interpretation of the coefficient for the interaction term “summer*post”.
5. Replicate Panel B (States Not Participating in NBP) of the Appendix Fig. 2.
Hint: To obtain the dash line, compute year-over-year averages of “nox_emit” for all counties with “nbp”=0 and “summer”=0.
6. Counties in eastern states (i.e., those with “nbp”=0) are not regulated by the NBP program. Therefore, there is no reason to expect the introduction of the NBP program in 2003 would affect NOx emissions in counties with “nbp”=0. Explain what is the point of Panel B of the Appendix Fig. 2.
Hint: What is the logic underlying a “placebo” test?

7. Clearly state, estimate, and report a difference-in-differences regression that examines the effect of the NBP program on NO_x emissions corresponding to Panel B of Appendix Fig. 2. Provide a one-sentence interpretation of the coefficient for the interaction term “summer*post”.
8. Clearly state, estimate, and report a triple-difference regression that examines the effect of NBP program on NO_x emissions. Discuss how the coefficient for the interaction term “nbp*summer*post” relates to your answers to question 4 and question 7.
9. Suppose that your job is to provide a retrospective analysis on the impact of the NBP program for the Environmental Protection Agency. Write a short summary of 200 or fewer words describing what you have found in your analysis of the NBP data. In particular, based on your triple-difference estimate, provide a calculation on how much NO_x emissions *in total* has the NBP program reduced from 2003 to 2007?

DATA DESCRIPTION, FILE: nbp.dta

The data consist 55,858 county*year*summer level observations. For more details on the construction of the variables included in this data set, please see DGS 2017.

Variable Definitions in nbp.dta

Variable	Label
<i>fips_county</i>	FIPs code county
<i>year</i>	Year
<i>summer</i>	1 if summer months
<i>nox_emit</i>	NOx emissions from power plants, million tons
<i>fips_state</i>	FIPs code state
<i>nbp</i>	1 if states regulated by the NBP
<i>post</i>	1 if year post 2003

Note: This table describes the variables included in nbp.dta.