

FIE401 - Final Project

Does political representation affect firms' decisions to pollute?

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Abstract

In this paper we test whether political representation has an effect on firm's decision to pollute. We investigate the relationship between facility's emission levels and Republican or Democrat representatives at power in the district. We account for a potential bias by narrowing down the sample to marginal wins per district and find that Republican governed districts result in higher pollution, and vice versa. Lastly, we find that a change in power from Democrats to Republicans is associated with an increase in emissions in the facilities, however the reverse change does not lead to emission reduction.

Introduction

In this study, we examine the effect of political representation on firms' decision to pollute. This is economically and environmentally important and can give insights on whether political and policy changes decrease or relocate emission. The decision of Amazon from 2019 to abandon the plan to build a headquarters due to opposition of local politicians provides one example of such connection and motivates the research question.

In order to explore the relationship between the political pollution preferences and facility emissions, we focus on two leading US political parties: Republicans and Democrats, as it is well-known that Democrats vote for environmental bills and Republicans oppose them. We investigate the effect by first looking at the impact of partisanship on air emissions. To reduce endogeneity concerns, we use panel regressions, which allow us to use fixed effects to control for unobserved variables. We find a negative and significant effect of partisanship on emission. This is contradictory to what we initially thought when discovering that Republicans tend to vote against environmental bills. This would indicate a positive relation between partisanship of Republican districts, but we found the opposite. We therefore applied a quasi-experimental approach and run regressions with less distribution in the data in relation to the portion of votes for the winning parties. The result was in line with our initial thoughts. Pollution went up in districts with Republican winners. To answer the main research question, we additionally use a difference-difference approach and show that indeed shift pollution from Democratic to Republican districts.

Data

For this analysis, we employ three datasets: one dataset includes data on elections in the House of Representatives, one dataset contains data on pollution, and the last data set includes data related to the facility locations of the firms. We clean the data in the following ways. First, we filter relevant variables to only report from 107th to 116th congress and chemicals that are regulated under the Clean Air Act. Moreover, we only keep partisanship parties, namely Republicans and Democrats, for simplification. Additionally, we exclude write-in candidates, because they are not affiliated with either of the parties and separate individuals are not distinguishable in the dataset. For the observations, which contain emission measurements in grams, we convert the values in pounds. After merging the data sets, we remove observations which have missing values for target variables. For the first regression, air emission in pounds is the dependent variable and partisanship/party the variable of interest. As control variable we use the change in production index. To get rid of outliers we Winsorize the upper bound of production index variables at 1% and at 5%. Table 1 shows the summary statistics of the continuous variables that are being used in our analysis. It is worth noting that “prodIndexChange” has a negative minimum value. This happens as the change from one period to another may result in a decrease in output at the facilities. We have limited the sample to around 454 thousand observations.

Table 1: Summary statistics

Statistic	N	Min	Pctl(25)	Mean	Pctl(75)	Max	St. Dev.
prodIndexNormLevel	454,736	0.000	0.477	1.303	1.222	27.789	2.547
prodIndexChange	454,736	0.000	0.890	1.002	1.100	5.000	0.408
emissionAir	454,736	0.000	9.000	5,234.587	2,202.000	45,675.940	11,979.700

Analysis

The effect of political partisanship on pollution

We first investigate the effect of political partisanship on pollution by running 3 regressions. This is done by regressing pounds of emission on a dummy variable whether the district is controlled by Republican or Democrat representative. The dummy turns one if Republican and zero for Democrat. As a base model we use a pooled regression without controls. In order to study variation of pollution within facility-chemical level we construct new entity identifiers by combining facility id and chemical id. Our second model is a panel regression with entity fixed effects on the facility and chemicals with controlling for production index and our third model additionally includes a time fixed effect. Table2 shows the results of this analysis.

Regression model 1: Pooled regression

In the first model we use a pooled regression method and investigate the relationship between the congressional districts politically governed by Republicans and the emissions caused by the facilities in that district. The coefficient is positive and statistically significant, indicating a positive relationship between the level of emissions and Republican representation in a district. This finding goes in line with intuitive expectation that polluting activity should be higher when the ruling party opposes environmental bills.

Regression model 2: Fixed Effects by facility-chemical

In the second model we conduct a panel regression with entity-fixed effect (by the combination of chemical and facility), where we add two control variables “Normalized production level” and “Production change relative to last year”. Contrary to the first regression, the coefficient is negative for partyREPUBLICAN, indicating that a district with a Republican representative will have a negative impact on the amount of emissions. Quantitatively, on average, this indicates a decrease of 220 pounds of emission in Republican districts. This gives us reason to believe that our estimates have an unobserved bias that need to be corrected

in order to get a correct estimate. Positive and statistically significant coefficient in front of production change indicates that the pollution levels increase with the increase of the output.

Regression model 3: Two-way fixed effects

In the third regression we conduct a two-way fixed effect panel regression. The coefficient indicates a negative and statistically significant relationship between Republican governed district and emission. We cannot include a facility-time fixed effects in the model because the fixed effects need to be “fixed” across one dimension and vary across another, i.e. time or entity. In a similar way it appears to be challenging to address time-varying unobserved effects across some states.

Table 2: The effect of political partisanship on pollution

	<i>Dependent variable:</i>		
	emissionAir		
	(1)	(2)	(3)
partyREPUBLICAN	513.545*** t = 5.322	-220.821*** t = -5.079	-67.904 t = -1.537
prodIndexChange		350.186*** t = 18.715	378.169*** t = 20.055
prodIndexNormLevel		89.976*** t = 8.474	133.428*** t = 12.474
Constant	4,939.365*** t = 62.031		
Observations	454736	454736	454736
Entity FE	no	yes	yes
Time FE	no	no	yes
Adjusted R ²	0.0004	-0.146	-0.145
F Statistic	204.320***	299.305***	428.447***

Note:

*p<0.1; **p<0.05; ***p<0.01

Causality between political partisanship and pollution

By using fixed effects in the panel regression we diminished omitted variable bias however, there is still one bias we are concerned about which is the sample selection bias. If sample selection bias occurs, we risk not achieving proper randomization in our research sample. In an ideal world we would run a controlled experiment and use random selection to measure the causal effect. To mimic this optimal scenario, we use a quasi-experimental approach, where we limit the sample to elections that were just won marginally (with up to 5% difference in votes between the winner and the runner-up). This is close to a random selection since election win (treatment) could not have been predicted. Therefore, the quasi-experimental approach helps identifying an unbiased effect, because it solves the sample selection problem we were concerned about and brings us nearer to our ideal experiment. Table 3 presents results of the same analysis as Table 2, but on a sample limited to marginal wins.

In the pooled regression (1) indicates positive relationship between Republican in power and the emission level, however unlike in Table 2 the coefficient is not statistically significant. Second model with entity-fixed effects and control variables, returns a positive and statistically significant coefficient, indicating that Republican district representation is positively related to the amount of emissions. This finding goes in line with the

intuition, potentially suggesting that the bias was the core issue for contradictory results in the Table 2. Two-way fixed effect panel regression leads to the same conclusion as model (2).

Table 3: Causality between political partisanship and pollution

	<i>Dependent variable:</i>		
	emissionAir		
	(1)	(2)	(3)
partyREPUBLICAN	-119.981 t = -0.569	513.767*** t = 4.527	258.130** t = 2.108
prodIndexChange		272.497*** t = 3.249	269.695*** t = 3.179
prodIndexNormLevel		190.917*** t = 3.786	225.664*** t = 4.406
Constant	5,287.486*** t = 33.735		
Observations	25396	25396	25396
Entity FE	no	yes	yes
Time FE	no	no	yes
Adjusted R ²	-0.00002	-0.719	-0.723
F Statistic	0.614	35.293***	28.428***

Note: *p<0.1; **p<0.05; ***p<0.01

Shift of pollution from Democratic to Republican districts

We use difference in difference approach with the change in emissions of specific chemical on a specific location as the dependent variable, defined as the difference between the emissions in the period t and period t-1. We conduct 2 experiments. First with the treatment group being the districts where the switch from Democratic to Republican occurred and the control group where Democratic party was in power and stayed in power. Second with the treatment group being districts where the switch from Republican to Democratic occurred and second control group where Republican party was and stayed in power. We construct an additional variable “share.REP” which is calculated as the fraction of the facilities that one firm has in republican districts relative to the total number of the facilities.

Table 4 demonstrates that in the first experiment (regression 1 and 2) the interaction term is positive and statistically significant on a 10% level. Thus, it might be a sign that a change in power from Democratic to Republicans is associated with an increase in emissions in the facility. The control variable for the share of the facilities is positive, but not statistically significant, therefore a conclusion can be made that there may not be a significant effect of facility distribution across political districts on emission change. The second experiment returns positive, but not statistically significant interaction term.

Conclusion

In this exam, we examined the effect of partisanship on pollution and find that districts lead by Republican increases pollution. We initially discovered what we believed was a biased coefficient related to sample selection. In the first part of our analysis, this relationship was negative, indicating that pollution would decrease with Republican governing. We found this counterintuitive as we know that Republicans tends

Table 4: Shift of pollution from Democratic to Republican districts

	<i>Dependent variable:</i>		
	change.emissionAir		
	(1)	(2)	(3)
I(after *treatment)	94.971* t = 1.881	94.983* t = 1.882	18.741 t = 0.308
after	-93.240*** t = -5.069	-93.238*** t = -5.069	-59.135*** t = -3.644
treatment	-42.268 t = -1.314	-45.103 t = -1.328	-55.580 t = -1.235
share.REP		6.253 t = 0.248	-16.047 t = -0.652
Constant	-136.728*** t = -12.948	-138.742*** t = -10.422	-117.574*** t = -5.746
Adjusted R ²	0.0002	0.0001	0.0001
F Statistic	10.066***	7.560***	4.613***
<i>Note:</i>		*p<0.1; **p<0.05; ***p<0.01	

to vote against environmental bills, indicating an increase in pollution for states governed by Republicans. After correcting the samples to contain only the districts that were won marginally by either Democrats or Republicans, we eliminated the bias. The outcome was a relationship more in line with our expectations, and we found that pollution actually increase in these states, as opposed to state with Democratic congress. To answer the question whether a shift in the partisanship just lead to a firms' decision to relocate the pollution, we use a difference-in-difference approach to try and solve this question. We found that firms shift the pollution from Democratic to Republican districts. This makes sense as states with Republican congress tend to pollute more.