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Environmental regulation, regulatory spillovers and rent-seeking

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Abstract
How do special interests react to an increase in their regulatory burden? In this paper, I use a shock to the regulatory environment by analyzing state-level enforcement of the Clean Air Act during the fracking boom. First, I show that fracking is associated with an increase in state regulatory activities for non-energy-related industries, generating regulatory spillovers to firms unrelated to fracking. Using the fact that fracking had regulatory spillovers to other industries, I use the presence of fracking as an instrument for environmental regulation for non-energy-related firms. I find that increased environmental enforcement is associated with an increase in state campaign contributions going to Republicans, and particularly to legislative races in competitive districts. These results provide some of the first evidence that changes in the regulatory environment can spur private sector mobilization with the potential to affect broader areas of policy through its electoral consequences.

Keywords Environmental regulation · Campaign contributions · Fracking · Rent-seeking

JEL Classification D72 · D73 · G38 · Q48

1 Introduction

Regulation is a central part of public policy. As government regulation can have a crucial impact on business, it is not surprising that the private sector has a large stake in regulatory outcomes. There is a vast literature in American politics on the influence of special interest groups (SIGs), and how money in politics and political connections can benefit private actors with more lenient treatment from regulators (Gordon & Hafer, 2005; de Figueiredo Jr & Edwards, 2007; Lambert, 2019; Heitz et al., 2021). Consistent with rent-seeking behavior (Tullock, 1967), firms can divert resources from productive activities to try to

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influence regulatory outcomes, at least in those situations in which the costs of influence are smaller than the costs of compliance.

Analyzing regulation and interest groups' behavior empirically is challenging since regulation is not random. Changes in regulation can be the result of changes in the relative power of SIGs (Anzia, 2018). Therefore, we need a source of exogenous variation in regulatory intensity to identify its effects clearly. In this paper, I study a regulatory shock to the non-energy sector caused by the fracking revolution in the US to examine how firms adjust their political participation patterns when faced with an increase in the regulatory burden. In particular, I focus throughout most of the paper on manufacturing firms, which are the most highly-pollutant ones besides the energy sector. Manufacturing should not be directly affected by fracking while it is also a sector with a high stake on environmental regulatory enforcement. I exploit the regulatory spillovers caused by fracking to other industries to obtain plausibly exogenous variation in enforcement intensity.

First, I analyze how the development of the fracking industry affected the enforcement of the Clean Air Act (CAA) at the zip code-level in the seven states where most of this industry was located between 1990 and 2014. Following Sances and You (2022), I apply a difference-in-differences design using the year 2005 as the time at which technological advances made fracking economically viable, and show that the non-energy sector experienced a significant increase in regulatory activities. At the zip code level, having at least one fracking well increases the number of regulatory actions for non-energy firms by 23%.

Such an increase in the regulatory burden should have uneven consequences across the political spectrum. Politicians use different methods to influence bureaucratic agencies (McCubbins et al., 1987; McCubbins & Schwartz, 1984; Shipan, 2004), and it has been shown that contributions can facilitate access to politicians (Kalla & Broockman, 2016). I predict that an increase in environmental regulatory activity will mobilize the affected interest groups to increase their campaign contributions, but that this mobilization should disproportionately benefit Republican candidates. The Democratic and Republican Parties have very different positions regarding private sector regulation and the environment, with the latter historically being more opposed to stricter environmental protection (Karol, 2019).

Given that the fracking boom is associated with a plausibly exogenous increase in regulation for non-energy-related firms, I use the presence of fracking as an instrument to analyze how increased enforcement affects the political participation of regulated firms. The validity of the instrumental variable (IV) design rests on the exclusion restriction of the instrument. If the presence of fracking affects campaign contributions through channels other than CAA enforcement, the results would be biased. One possibility is that fracking generates income effects in these communities, affecting political spending. Although I cannot completely rule out this possibility, I show a series of extensions and checks that support the interpretation that my design is capturing the effect of environmental regulation and not some income effect due to fracking.

The results show that regulatory enforcement of the CAA for non-energy firms is associated with an increase in contributions to Republican candidates in legislative state races, with this effect driven by manufacturing firms, while I find no effect for Democratic candidates. Then, I investigate the strategy followed by interest groups who increased their contributions. I do not find evidence that SIGs are following a legislative strategy targeting incumbent legislators. Instead, I show that the increase in political spending is driven by contributions to races in competitive districts, consistent with an electoral strategy. Moreover, this effect is present in the states that had a Democratic majority in the state House before the fracking revolution began.

This article makes three contributions to the extant literature. First, I analyze a regulatory shock and its effects on SIGs' political mobilization. In this context, affected firms have more incentives to spend money in politics, favoring the Republican party. Tullock (1967) first noted that the cost of regulation includes the cost of rent-seeking behavior to capture a positive rent (or avoid a negative rent) associated with the regulation. Authors such as Buchanan and Tullock (1975) and Kellner (2023) extend the economic theory of regulation to environmental policy focusing on the election of policy instruments. In this paper, I show that rent-seeking costs also include the spillover rent-seeking activity related to environmental regulation. More specifically, the economic shock that led to increased regulation for energy firms is associated with increased rent-seeking in non-energy related industries due to spillovers. By this change in the regulatory burden, Republican politicians are able to gain more resources from the private sector in the form of campaign contributions. Moreover, I show not only that SIGs react to increased regulation by increasing their political spending, but also that the electoral strategy they follow can have consequences far beyond the realm of environmental regulation.

Second, states have been a key driving force in environmental policy in the US in the last few decades. In an influential recent study, Stokes (2020) shows how the energy sector has used its resources to hamper environmental policy across various states. I expand the analysis of interest groups at the state level to show how they use resources, such as campaign contributions, to affect not only state environmental policy but also how federal regulation is administered and enforced. Finally, this paper contributes to the literature on the politics of environmental enforcement. Although a significant part of this literature has focused on the effect of partisanship or electoral results on outcomes such as inspections of penalties (Innes & Mitra, 2015; Elrod et al., 2018; Fredriksson & Wang, 2020), few studies have analyzed how special interests can affect environmental regulatory enforcement. As shown in this paper, most enforcement is performed by state environmental agencies and failure to account for this fact can obscure empirical findings (Anzia, 2022). More generally, my results highlight the importance of carefully selecting the level of government and the type of regulatory outcome when examining the influence of interest groups.

2 The fracking revolution

The fracking revolution represented one of the largest shocks to the US energy sector. It enabled the US to move from being the largest oil importer in the world to being a net exporter. By 2015, hydraulic fracturing generated two-thirds of natural gas production; by 2019, it generated two-thirds of oil production. It also remains a contentious issue in American politics today. As fracking is mostly regulated by states, there is much variation at the subnational level. While some states have actively promoted it, at the other extreme, New York (a state with substantial fracking reserves) banned this industry in 2015.

Fracking has had a considerable economic impact on the communities where extraction takes place, raising employment and wages (Feyrer et al., 2017). In addition to its economic effects, fracking has caused alarm in environmental groups, politicians, and large segments of the public. Water pollution and the risk of seismic activity have received much attention, and some researchers have warned that the gas and oil boom may have broader implications for climate change and greenhouse gas emissions. For example, Howarth (2019) finds the fracking boom in the US to be responsible for reversing the downward trend in methane emissions around 2006.

A recent literature has also brought attention to the political consequences of fracking. Studies have shown that fracking is associated with better electoral performance by Republicans and swaying legislators' roll-call votes in a more conservative direction (Cooper et al., 2018; Fedaseyeu et al., 2018). Focusing on contributors and voters, Sances and You (2022) find that Republican candidates benefit from an increase in contributions and from a decrease in turnout that negatively affects Democratic candidates. Similar patterns have been found in state legislatures where shale oil and gas are associated with an increase in contributions to Republicans in historically blue districts (Disalvo & Li, 2020).

Other studies have narrowed the electoral focus to incorporate the environmental consequences of fracking into the analysis. For instance, Raimi et al. (2020) show that Republican voters were more likely to reject proposition 112 in Colorado (which would have restricted the available land for oil exploration). Boomhower (2024) analyzes elections for governors and energy regulators in Oklahoma and Texas to study the impact of fracking-related earthquakes on electoral outcomes. Although the results show that there is a negative effect for Republican energy regulators, gubernatorial Republican candidates suffer no electoral punishment for these events.

3 Environmental enforcement in the US

To study the effects of regulation on private political behavior, I focus on the enforcement of one of the most substantial pieces of legislation in US environmental policy, the CAA. Although this is a federal legislation, the largest share of regulatory actions are executed by states and their environmental agencies.[1] While the EPA is responsible for overseeing states' actions, its power over the states is limited, and its formal tools to act against a state that is shirking its job are rarely used (Clysdale, 2003).

There are a number of ways in which state politicians can affect environmental enforcement, some more directly than others. First, governors and state legislatures control the budgets of the state environmental agencies entrusted with the task of enforcing environmental standards. For the seven states considered in this paper-all of which show electoral gains for the Republican Party during the period of analysis-there is a decrease in the staffing of state environmental agencies, with Louisiana leading the ranking with a decrease of 30% in the 2008–2018 (Environmental Integrity Project, 2019).[2]

State politicians can contact state bureaucrats directly. A Freedom of Information Act request submitted to the Texas Commission on Environmental Quality (TCEQ), one of the most important state environmental agencies in the country, reveals that the governor and state legislators regularly contacted this agency (much more frequently than other elected officials, such as members of Congress). Records of those communications show that state politicians usually showed support for or opposition to how the TCEQ was handling areas of its work, or asked for particular actions, such as granting or denying a permit to a firm.[3]

[1] For the seven states in this analysis, state environmental agencies carried out 77% of all regulatory actions under the CAA. State agencies conducted 341,769 regulatory actions; the federal EPA performed 102,494.

[2] https://environmentalintegrity.org/news/state-funding-for-environmental-programs-slashed (accessed on March 16, 2023).

[3] Between 2000 and mid-2021 more than 80% of communications between the TCEQ and elected politician involved state legislators (55% of total communications) and the governor's office (27% of total communications).

Finally, some states have directly opposed the EPA's federal guidance with, for example, judicial actions. Many states opposed President Obama's Clean Power Plan and sued the EPA. Governors, such as Mike Pence from Indiana, said publicly that they would not comply with the new restrictions on carbon plants. Resistance also came from state environmental regulators. In 2014, Bryan Shaw, head of the TCEQ, resisted this new regulation of power plants. The Texas Public Policy Foundation, a conservative think tank, worked with Texas state legislators to oppose the new regulations. In the end, 26 states sued the EPA and, in 2016, the Supreme Court halted implementation of the Clean Power Plan. Six years later, in *West Virginia v. EPA*, the Supreme Court ruled that the EPA lacked the authority to regulate emissions under the framework of the Clean Power Plan.

4 Regulatory costs and political mobilization

Regulatory outcomes are important to firms because regulation is costly. If a firm complies with new regulations, the burden of the regulation is driven by the adaptation costs. If regulators discover a firm's noncompliance, the firm will likely face a cost; the most direct form of costs is fines. Noncompliance with rules, such as environmental regulations, can also have indirect costs, such as reputational and consumer backlash, or negative results in the stock market (Badrinath & Bolster, 1996). Importantly, firms can use their resources to influence politicians and regulators in an effort to avoid the adverse consequences of noncompliance. Therefore, at least for cases in which the cost of gaining this influence is lower than the costs of the new regulation, the expectation is that firms will try to use tools such as campaign contributions or lobbying to receive better treatment by regulators.

4.1 Partisan differences

There is a huge divide between Democrats and Republicans regarding environmental protection (Egan & Mullin, 2017; Karol, 2019). According to Bergquist (2020), partisan polarization in environmental issues started in the 1990 s and was exacerbated after the Great Recession. These partisan differences manifest in the public's assessment of the EPA and its mandate. The 2014 round of the Cooperative Congressional Election Study (CCES) shows that support among Democrats for EPA enforcement is more than double that among Republicans. In fact, partisanship and ideology are the strongest predictors of climate attitudes (Hornsey et al., 2016)

These differences also translate into the political arena and have consequences for environmental policy. During Donald Trump's presidency, even as no major change was made to important legislation such as the Clean Air Act or the Clean Water Act, criminal prosecutions under these statutes dropped by 50% and 70% respectively during the first two years of his tenure (Schwartz, 2020). Such a change in enforcement had clear and dramatic impacts. Clay et al. (2021) show that the increase in air pollution, a consequence of the lax regulatory approach of Trump's administration, was responsible for almost 10,000 deaths between 2016 and 2018.

The empirical evidence shows that this partisan divide has consequences for environmental policy and regulation at the federal and state level (Innes & Mitra, 2015; Elrod et al., 2018; Fredriksson & Wang, 2020). Fowler and Kettler (2020) show that state Republican politicians are associated with higher levels of pollution, but only when the governor and the legislative majority are Republicans.

Other studies look deeper into the relationship between partisanship and environmental regulatory outcomes to shed more light on the mechanisms. Bergquist (2019) finds that the executive and legislative branches affect environmental regulation, but in somewhat different ways. While governors can influence environmental agencies through staffing, the legislature can use mechanisms such as oversight and budgetary control. The party of the governor affects informal enforcement (letters of warning), but the majority in the legislature affects formal actions (such as administrative penalties or judicial cases). González and You (2023) show that state agencies are less likely to join EPA in civil judicial cases when defendant firms have political connections with Republican state legislators. The authors show evidence consistent with state legislators using direct communication with regulators to influence their behavior.

Therefore, my first hypothesis is that firms seeking to reduce the costs of environmental regulation will favor the Republican Party with their political spending.

4.2 The level of government

Given the federalist structure of regulatory enforcement for many agencies, such as the EPA, it is likely that special interests are actually responding to this increase in regulatory enforcement by targeting state politics. Many federal agencies rely on states and other subnational units to conduct monitoring and enforcement. Under the CAA, for example, state environmental agencies conduct most of the regulatory activities. There are reasons to believe that interest groups can be more influential at the subnational level. State politics is also salient and publicized, and it is less likely that opposing interest groups clash at the state level (Anzia, 2018). In addition, citizens' knowledge and participation are lower at the state level (Anzia, 2022). The second hypothesis, then, is that the increase in the share of contributions to Republicans due to environmental enforcement should be concentrated in state races.

4.3 Legislative vs. electoral strategies

From the previous discussion the expectation is that firms affected by more environmental regulation would target Republican candidates, and that they would do so in state races. Still, we need to consider the strategies of firms and how they would use their contributions. A classic distinction in the literature of money in politics is between legislative and electoral strategies. According to the former, contributions are targeted to incumbent politicians in order to receive favorable policy changes. In turn, an electoral strategy aims at helping like-minded politicians get elected.

It is not clear which of these strategies firms affected by increased regulation would follow. But each has different empirical implications that can be tested. If firms follow a legislative strategy, they would contribute to incumbent Republicans. Moreover, following this strategy, contributing to safe races would be less risky for firms since there is a lower chance of wasting their money on a losing candidate. On the other hand, if what prevails is an electoral strategy, we expect a stronger effect for competitive races. This distinction is also important because it entails different consequences. If regulation is making firms more likely to follow a legislative strategy, the effects should be limited to this policy issue. But if firms pursue an electoral strategy, the change in electoral outcomes can have consequences that go beyond environmental regulation.

5 Fracking and environmental enforcement

In this section, I analyze how the fracking boom affected state-level environmental enforcement activities, with a focus on the non-energy sector. To this end, I rely on two data sets. The first includes information on fracking wells at the zip code-level, compiled by Sances and You (2022). I focus on the seven states where the fracking boom was more pronounced: Arkansas, Louisiana, North Dakota, Oklahoma, Pennsylvania, Texas, and West Virginia. With this information, I construct a variable that counts all horizontal wells in a given zip code in a given year.

Second, for information regarding environmental enforcement, I use data from the Air Facility System (AFS) compiled by the EPA, from 1990 to 2014. Each activity is recorded with the corresponding date and zip code of the facility being audited. Given that a single action by state regulators can have more than one record in the AFS, I use activity and facility information, as well as enforcement dates, to ensure that each regulatory action is only counted once. The sample for the seven states considered here includes 225,169 unique state regulatory activities for 39,736 unique facilities. This facility-level information is aggregated at the zip code/year level to match with fracking data. I use the NAICS codes for each facility in the AFS data to create a measure of regulatory activities for non-energy environmental regulation at the zip code level.[4]

The main regulatory enforcement measure is total regulatory actions, which is constructed by counting every regulatory activity on the non-energy sector under the CAA and aggregating it at the zip code/year level. There are different types of regulatory activities that can have different impacts and costs on private firms. I construct a second variable using only state formal enforcement actions. These enforcements include any administrative or judicial penalty or agreement, judicial referrals, complaints, and notices of violation. I identify all such enforcement actions in the AFS data and aggregate them to create a measure of formal enforcement at the zip code/year level.[5]

To estimate the effect of fracking on environmental regulation, I follow the approach by Sances and You (2022). Taking 2005 as the year in which technological developments made fracking a profitable industry, I apply a difference-in-differences design that compares CAA enforcement in zip codes with at least one fracking well with those that do not register a well between 1990 and 2014.

The econometric specification is as follows:

$$\begin{aligned} log(1 + CAA_{i,t}) &= \alpha + \delta\, fracked_i + \gamma\, Post\, 2005_t + \\ &\beta\, (fracked_i * Post\, 2005_t) + \nu \mathbf{X}_{i,t} + \theta_i + \eta_t + \epsilon_{i,t}, \end{aligned} \tag{1}$$

where i and t represent zip codes and years, respectively. $CAA_{i,t}$ stands for the measure of total regulatory activities in the non-energy sector. The variable $fracked_i$ takes a value of one if a zip code registered a fracking well at any point during the period of analysis, and zero otherwise; while $Post\, 2005_t$ takes a value of one for all years starting in 2005. The coefficient of interest is β, which is the difference-in-differences estimate. $\mathbf{X}_{i,t}$ is a set of control variables, including the number of workers and the number of private establishments at the county level (in logs), taken from the Quarterly Census of

[4] The NAICS codes used to identify oil-/gas-related industries are shown in Table 6 in the Appendix.

[5] It is possible that an entry in the AFS data corresponds to a notice of violation and another entry to a penalty assigned for that same violation. In these cases, I only count such activities as one formal enforcement.

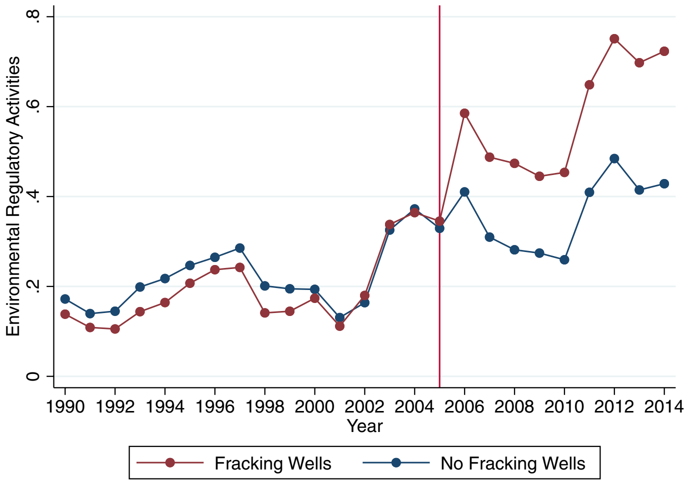

Fig. 1 Parallel Trends: Environmental Regulatory Activities *Notes*: Environmental regulatory actions at the state level (in logs) for non-energy firms in zip codes with fracking (red) and zip codes without fracking (blue). The red vertical line is the treatment year

Employment and Wages (QCEW).[6] θ_i and η_t are zip code and year fixed effects, and $\epsilon_{i,t}$ is the error term. Standard errors are clustered at the zip code level. Summary statistics for the variables used in this section are presented in Table 7 in the Appendix.

5.1 Difference-in-differences

Figure 1 shows the evolution of the log of CAA actions (plus one) for non-energy firms in fracked and never-fracked zip codes between 1990 and 2014. The red vertical line in 2005 represents the treatment year. Before 2005, the two groups moved in a similar way, and the mean level of regulatory actions in the fracked and never-fracked zip codes is very similar. The divergence between the two groups starts in 2005 and continues over time.

Using the specification in Eq. (1), I find a significant and positive effect of fracking on regulatory activities. As shown in Column 1 of Table 1, having at least one fracking well increases the number of regulatory actions by 23%, a large effect consistent with the divergence between the two groups in Fig. 1. Non-energy facilities should not be directly affected by fracking, but I still find a large effect on regulation.

Given that fracking caused an economic boom, it could have led to more jobs and new companies in non-energy industries. If that were the case, enforcement could be mechanically increasing. I estimate the same specification as in Column 1, including the number of workers and the number of private establishments at the county level as controls, and the results, as shown in Column 2, are almost unchanged. In Columns 3 and 4, I estimate the same specifications, but using the total number of facilities regulated in a given zip code/year as the dependent variable. Having at least one fracking well increases the number of

[6] There is no such information at the zip code level; therefore, I assign all zip codes within the same county the same values for employment and establishments.

Table 1 Fracking and environmental regulation on non-energy industries

	(1) Actions	(2) Actions	(3) Facilities	(4) Facilities	(5) Formal	(6) Formal
Fracked x	0.231***	0.229***	0.159***	0.159***	0.206***	0.209***
Post-2005	(0.017)	(0.017)	(0.011)	(0.011)	(0.019)	(0.019)
Mean DV	0.29	0.29	0.22	0.22	0.15	0.15
Controls	No	Yes	No	Yes	No	Yes
Zip code FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	146,500	143,275	146,500	143,275	146,500	143,275
Zip codes	5860	5731	5860	5731	5860	5731

All dependent variables in logs. *Actions* is the total number of environmental activities, *Facilities* is the total number of facilities that received at least one regulatory action, and *Formal* is the total number of formal environmental activities. The variable *Fracked* * *Post-2005* is the difference-in-differences estimate. Controls include the log of total employment and the log of total establishments (both at the county level). All specifications include zip code and year fixed effects. Standard errors are clustered at the zip code level. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

regulated non-energy facilities by 16%. Finally, In Columns 5 and 6, I show that fracking is also associated with a considerable increase in formal enforcement activities.

There might be other indirect channels, such as firms who are suppliers to the energy sector benefiting from fracking, that are not captured by the control variables above. Feyrer et al. (2017) show that fracking led to important increases in wages and employment, but most of these gains are concentrated in fracking or energy-related industries such as natural resources or utilities, which I consider oil-related in the empirical analysis. Building on these findings, I use data from the QCEW to construct measures of employment by different industries at the county level and conduct a difference-in-differences analysis similar to Eq. (1). In Table 8 in the Appendix, I show that fracking is associated with an increase in total employment for energy-related industries, although the effect seems to be driven mainly by the natural resources industry. Then, I conduct the same analysis for non-energy-related industries in Table 9 and find no significant effects of fracking. I also show that there is no effect on employment in manufacturing, professional services, leisure, or education. Although indirect, this evidence supports the conclusion that the increase in regulatory enforcement in places with fracking is not only a consequence of higher economic activity.

5.2 Regulatory spillovers

Why do non-energy facilities in fracking areas face more regulatory enforcement? One possibility is that fracking is changing the composition of facilities, making the average facility dirtier and more likely to be regulated. To check for this mechanism, I use the Toxic Release Inventory (TRI), compiled by EPA. This program does not cover all industries, but it includes the most pollutant ones such as energy, manufacturing, mining, and chemicals. With zip code information on each facility I can match it with my data on fracking wells.

To check if facilities in fracking areas became dirtier, I create an unbalanced panel with all non-energy facilities in TRI and estimate a similar difference-in-differences specification as in Eq. (1), including firm and year fixed effects. I use three dependent variables: fugitive emissions, stack emissions, and total emissions combining both. These variables include all air pollutants. As is standard when working with this type of data, I measure these variables in pounds and take the log (Fowler & Kettler, 2020). Results in the first three columns of Table 10 show that fracking has no effect on any of these variables. As a further check, I restrict the toxic substances to only those regulated by the CAA and show the results in Columns 4, 5 and 6 of Table 10. Results again are insignificant. Therefore, the evidence suggests that firms did not become dirtier because of fracking developments in the area.

Another possibility is that fracking generated a spillover effect of regulation to other facilities in the area. Besides its economic benefits, fracking is a contentious issue that has mobilized the opposition of many groups. Raff (2023) shows how citizens' complaints after a coal ash spill in Tennessee led to increased regulation in facilities unrelated to this incident in nearby areas. If environmental concerns increase, politicians have the incentives to push state agencies to act more in those areas. I test this spillover mechanism with data on oil-related environmental complaints in Pennsylvania compiled by Public Herald (Troutman et al., 2017). Using a similar difference-in-differences specification as in Eq. (1) at the county level, in Table 11 I show that complaints in Pennsylvania experienced a large increase when the fracking industry started booming around 2005. Overall, the evidence is consistent with fracking generating a negative externality to other industries in the form of regulatory spillovers in response to citizens' complaints.

6 Regulation and political participation

In this section, I use the fact that the development of the fracking industry had spillovers to other industries as an instrument to estimate the impact of increased regulatory burden on private political participation for non-energy firms.

6.1 Data and empirical specification

In this section, I work with data at the firm level. To construct the sample, I start with facility-level information from the AFS. First, I drop all observations for government entities or government-owned facilities. A next step is to match each facility with its parent firm. Although some facilities could not be matched with a firm, I identify around 2,600 firms in the AFS data, which covers 70% of all regulatory activities on private facilities under the CAA in the seven states I examine. Out of this, 1,904 firms are non-energy related. Once I identified all firms that faced regulatory actions under the CAA at least once, I construct a panel at the firm/state and electoral cycle level. Firms that registered a regulatory action in t, but not in t+1, get a zero for the regulatory measure in t+1.[7]

Each state conducts its own environmental enforcement, and firms can operate in multiple states. Working at the firm/cycle level would capture, for example, the effect of enforcement by Texas environmental regulators on political contributions to Pennsylvania

[7] It is possible that some firms were not active in all years between 1998 and 2014. I manually search for information on each firm and restrict the sample according to the dates in which firms started and/or stopped working. Because of this, the panel is unbalanced; although most firms in my sample -especially large ones- operated for the entire period.

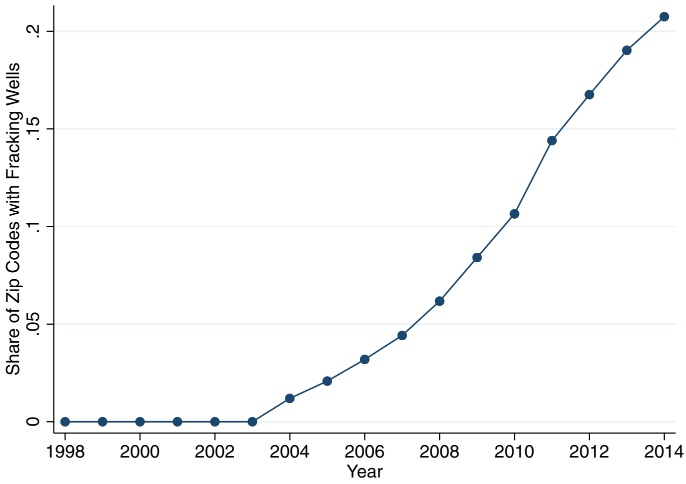

Fig. 2 Fracking Developments Over Time. *Notes*: Share of total zip codes with at least one fracking well

state politicians, which makes little sense. Therefore, I also aggregate the data at the state level. If a firm has at least one facility in a different state, then the firm appears more than once in the sample.[8] I focus on formal regulatory actions, because it is likely that firms are more responsive to these types of regulatory actions. To analyze how environmental enforcement affects the patterns of political spending by the private sector, I use data on campaign contributions from the Database on Ideology, Money in Politics, and Elections: Public version 2.0 (DIME), compiled by Bonica (2018). I measure all corporate contributions (PACs) from firms in my sample to state races. Then, I manually match each firm/state observation to its corresponding contributions.[9] This is a crucial point in constructing the sample. I include only contributions from firms regulated by the CAA, and only those contributions made to races where a particular set of regulatory actions took place. With this approach, I avoid finding spurious relationships between enforcement in one state and political activity in another.

6.2 Instrumental variables design

I instrument state regulatory activities to the non-energy sector with the presence of fracking. In particular, I use the presence of fracking wells in the zip code in which a facility is operating as an instrument for CAA regulation. In the cases in which a firm has more than one facility in different zip codes, I assign a value of one to this variable if any facility is located in a fracking zip code. Even with no data on actual production, the presence of fracking wells should be a good proxy for the fracking industry. As shown in Fig. 2, the

[8] The sample includes a total of 1904 unique non-energy firms and 2,463 firm/state units, meaning that most firms operate in a single state. Nonetheless, firms that operate in multiple states are larger, on average, than single-state ones and possibly spend more money on campaign contributions.

[9] If firm *i* operates in states *j* and *k*, I assign to observation *ij* contributions to state *j*, and to observation *ik* contributions to state *k*.

Table 2 Environmental enforcement and campaign contributions

	Campaign Contributions, in logs		
	(1)	(2)	(3)
	Total	Republican	Democratic
Second stage			
Log(1+CAA)	0.557**	0.545**	0.227
	(0.238)	(0.239)	(0.202)
First Stage			
Fracking	0.248***	0.248***	0.248***
	(0.045)	(0.045)	(0.045)
CD statistic	90.29	90.29	90.29
KP statistic	30.23	30.23	30.23
SY critical value	16.38	16.38	16.38
Mean DV	0.28	0.24	0.21
Firm/state FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	20,142	20,142	20,142
Firm/state	2258	2258	2258

All dependent variables are in logs. *Log(1+CAA)* is the endogenous variable of interest. *Fracking* is the instrument, which takes the value of one if a given firm in a given state operates a facility in a zip code with fracking. All specifications include firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. CD: Cragg-Donald, KP: Kleibergen-Paap, SY: Stock-Yogo. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

share of zip codes with at least one fracking well increased abruptly from almost zero at the beginning of the century, to more than 20% in 2014.

The validity of the research design rests on the exclusion restriction of the instrument. If the presence of fracking affects campaign contributions through channels other than CAA enforcement, the results would be biased. This is likely to happen for oil- and gas-related firms, as they were directly affected by fracking; therefore, my approach is not suitable for analyzing the response of this economic sector to increased regulation. Instead, I focus on non-energy-related industries which should not have been affected directly by fracking. In the following section I conduct a number of checks to strengthen the exclusion restriction.

The econometric specification for the first-stage regression is as follows:

$$log(1 + CAA_{ij,t}) = \alpha + \zeta \; Fracking_{ij,t} + \delta_{ij} + \theta_t + \nu_{ij,t}, \tag{2}$$

where ij and t represent firm/state units and electoral cycles (even years), respectively. $Fracking_{ij,t}$ is the instrument, which takes a value of one if firm i in state j had a facility operating in a zip code with fracking in cycle t. $\delta_{i,j}$ and θ_t are firm/state and cycle fixed effects, and standard errors are clustered at the firm/state level.

The second-stage regression, which estimates the effect of CAA regulatory activities on campaign contributions, is as follows:

Table 3 Regulatory enforcement on manufacturing firms

	Campaign Contributions, in logs						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Total	Republican	Republican Governor	Republican Legislative	Democrat	Democrat Governor	Democrat Legislative
Second stage							
Log(1+CAA)	0.620**	0.601**	0.184	0.517**	0.285	0.009	0.245
	(0.251)	(0.250)	(0.138)	(0.240)	(0.201)	(0.117)	(0.188)
First Stage							
Fracking	0.257***	0.257***	0.257***	0.257***	0.257***	0.257***	0.257***
	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)
CD statistic	83.37	83.37	83.37	83.37	83.37	83.37	83.37
KP statistic	28.14	28.14	28.14	28.14	28.14	28.14	28.14
SY critical value	16.38	16.38	16.38	16.38	16.38	16.38	16.38
Mean DV	0.29	0.25	0.11	0.23	0.21	0.06	0.20
Firm/state FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,395	17,395	17,395	17,395	17,395	17,395	17,395
Firm/state	1948	1948	1948	1948	1948	1948	1948

All dependent variables are in logs. *Log(1+CAA)* is the endogenous variable of interest. *Fracking* is the instrument, which takes the value of one if a given firm in a given state operates a facility in a zip code with fracking. The analysis is restricted to manufacturing firms. All specifications include firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. CD: Cragg-Donald, KP: Kleibergen-Paap, SY: Stock-Yogo. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

$$log(1 + Contributions_{ij,t}) = \alpha + \beta\, log(1 + \widehat{CAA}_{ij,t}) + \delta_{ij} + \theta_t + \epsilon_{ij,t}, \qquad (3)$$

where $log(1 + \widehat{CAA}_{ij,t})$ are the fitted values from Eq. (2), and β is the local average treatment effect. $Contributions_{ij,t}$ represents different measures of contributions to state-level races. Standard errors are clustered at the firm/state level.[10]

This specification does not include control variables besides fixed effects for two reasons. First, many firms in the sample are not large, publicly traded firms; thus, there is scant firm-level information available. Second, and more importantly, Blandhol et al. (2022) show that two-stage least-squares (2SLS) can be biased when covariates are used.

6.3 The effect of environmental enforcement

For this part of the analysis, I restrict the sample to the 1998-2014 period. The results for the IV design are presented in Table 2. Column 1 shows that regulatory enforcement is associated with an increase in total campaign contributions. An increase of 1% in environmental regulatory actions is associated with an increase of 0.56% in contributions, a sizable effect. Then, I analyze the effects by party. Environmental enforcement has a

[10] Summary statistics for the variables used in this section are presented in Table 12 in the Appendix.

positive effect on contributions to Republican candidates in state races (Column 2), but I do not find any effect for Democratic candidates (Column 3). Environmental regulation seems to be driving an increase in political participation by regulated firms, but only the Republican Party benefits from it.

The lower panel of Table 2 shows the first-stage results. In addition to the estimated coefficient for the instrument, I present the Cragg-Donald Wald F statistic and the Kleibergen-Paap rk Wald F statistic. As is standard in the literature (Bazzi & Clemens, 2013), I compare these statistics to the Stock-Yogo critical values. In both cases, the statistics are well above the critical values, which provides evidence that the instrument is not weak.

To assess the importance of the IV design, I estimate the same models as in the previous table, but instead of instrumenting CAA enforcement, I apply a naive OLS model. In this case, the expectation is that OLS coefficients are smaller than IV and naive regressions are downward biased. If SIGs are influential, it is likely that the status quo already reflects their power, so we might find null results without a proper source of exogenous variation. I show that this is the case, confirming the motivation for using the IV design. Results are shown in Table 13 in the Appendix. The estimated coefficients are very small and insignificant in the different models.

The main concern with this approach is that fracking could affect campaign contribution patterns through other channels, even for industries that were not directly affected by it. For example, fracking had economic effects that could affect contributions. I conduct a number of checks to assess the validity of the main finding that regulation increases political participation by non-energy firms, benefiting Republicans. First, I estimate the same model for contributions to candidates to Congress.[11] Given that CAA enforcement is mostly done by state environmental agencies, if my hypothesis is correct and the results are driven by a response to regulation, we should see an effect on state-level races, but not on federal races. If, however, results are driven by the economic effects of fracking, the expectation is that contributions from affected firms will increase for state and federal races. The results for contributions to Congress are shown in Table 14 in the Appendix. I estimate the main model for total contributions to legislative federal races, and for Republican and Democratic candidates, separately. The estimated coefficients are negative, small, and far from significant, supporting the main results in this section and the empirical approach.

Then, I estimate the same specifications as in Table Table 2 using the log of federal lobbying spending from Kim (2018) as a control. As Kerr et al. (2014) show, lobbying spending is correlated with firm size, and it is a variable that is available for all firms in the sample. The results shown in Table 15 in the Appendix remain basically unchanged. Finally, fracking could have increased government revenue, which could have been directed to enforcement activities in pollutant industries. This, nonetheless, is unlikely given that most states in my sample experienced a reduction in the real budget of their environmental agencies during the period of analysis.

6.4 Endogeneity concerns

Even after the previous checks, violations to the exclusion restriction might persist. The fracking industry has been linked with economic booms in places where production

[11] I exclude presidential elections as these races are national and not restricted to a particular state.

takes place. Therefore, firms unaffected by environmental regulation could increase their contributions to Republicans to sustain the energy boom that has benefited them, even if this link is not direct. To strengthen identification, I conduct separate analyses for manufacturing and non-manufacturing firms. Manufacturing is the most heavily CAA-regulated non-energy industry; therefore, environmental regulation is likely of concern or can affect those businesses in a nontrivial way.[12] Non-manufacturing firms are not as heavily regulated by the CAA as manufacturing firms; hence it is unlikely that environmental enforcement is a relevant determinant of their profits. If my results were driven by income effects due to fracking, it is not clear why we would see stronger effects for manufacturing than for non-manufacturing. But, if my design captures the effect of environmental regulation, the expectation is that the effect would be stronger for a high polluting sector like manufacturing.

In Table 3, I estimate the main IV specification for manufacturing firms.[13] In Column 1, I find a positive and significant effect on total contributions to state races. Then, Column 2 shows an effect for contributions to Republicans with an estimated coefficient which is larger than in the previous table. To shed more light in the specific dynamics linking regulation and political contributions, I divide total contributions by type of race. Results in Columns 3 and 4 show that, while there is no significant effect for contributions to gubernatorial races, I find a strong effect on contributions to legislative races. The remaining columns show no effect for Democratic candidates in any type of race.

Then, I estimate the same models as in the previous specification for non-manufacturing firms in Table 16 in the Appendix.[14] I find no effect of regulation on non-manufacturing firms for either party or type of race. Overall, these findings support the idea that my design is capturing the effect of environmental regulation and not some income effect to the non-energy sector.

6.5 Legislature vs. governor

Another relevant finding in Table 3 is that, while I find a positive effect for contributions to legislative races, I do not find any effect for gubernatorial races. Both the governor and the legislature hold power over state environmental agencies. The governor usually nominates the head of the agencies, and sometimes even the board of directors; although, in some states, nominations require state senate confirmation. On the other hand, the legislature can influence the behavior of these agencies through its oversight powers which include "police patrol" activities like hearings, reviews, sanctions, or "fire alarm" mechanisms (McCubbins & Schwartz, 1984). Finally, both governors and legislatures share power in determining the budget of state agencies.

Bergquist (2019) shows that governors affect informal regulatory activities that do not demand many resources (like inspections). On the other hand, the author shows that

[12] Manufacturing covers 60% of the total number of firms in the sample, and around 80% of all non-energy firms.

[13] To define manufacturing firms I use the NAICS codes in AFS. I exclude a few codes that are under the category of manufacturing but are directly related to the energy sector, such as petroleum lubricating oil and grease manufacturing.

[14] Weak instrument tests perform well for the specification including manufacturing firms, but not as well for the specification with non-manufacturing firms. This result is not surprising as the instrument should perform better for firms that are more heavily regulated by the CAA.

Table 4 Contributions to republicans in competitive districts

	(1) Contributions	(2) Contributor	(3) Num of legislators	(4) Contribution per legislator
Second stage				
Log(1+CAA)	0.362**	0.042**	0.079**	0.292**
	(0.146)	(0.018)	(0.032)	(0.120)
First Stage				
Fracking	0.257***	0.257***	0.257***	0.257***
	(0.048)	(0.048)	(0.048)	(0.048)
CD statistic	83.37	83.37	83.37	83.37
KP statistic	28.14	28.14	28.14	28.14
SY critical value	16.38	16.38	16.38	16.38
Mean DV	0.08	0.01	0.01	0.07
Firm/state FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	17,395	17,395	17,395	17,395
Firm/state	1948	1948	1948	1948

The analysis is restricted to Republican legislative candidates in competitive districts. The dependent variable in Column 1 is the amount of contributions in logs, a dummy which indicates if that particular firm/state contributed to these races in Column 2, the number of legislators donated to in Column 3, and the contribution per legislator in Column 4. *Log(1+CAA)* is the endogenous variable of interest. *Fracking* is the instrument, which takes the value of one if a given firm in a given state operates a facility in a zip code with fracking. The analysis is restricted to manufacturing firms. All specifications include firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. CD: Cragg-Donald, KP: Kleibergen-Paap, SY: Stock-Yogo. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

legislature affects formal resource-intensive enforcement (such as administrative or judicial processes that lead to a penalty). The legislature can change the resources available to regulatory agencies and influence administrative policy through oversight and procedural changes. Although my focus is on formal enforcements which are the most costly and relevant for private firms, in Table 17 in the Appendix, I estimate a similar specification as in Table 3 using informal enforcements as the endogenous variable. I find no effect of environmental regulation on gubernatorial contributions for either party.[15]

7 Dynamics of political mobilization

To study the strategies followd by SIGs, I restrict the analysis to legislative races in the state lower chambers. If the main motivation of firms to increase their contributions to Republican legislators is a legislative strategy, then the expectation is that firms would target incumbent legislators. Results for contributions to incumbent Republican legislators are presented in Column 1 of Table 18 in the Appendix. I find some evidence that

[15] These results should be taken with caution since the instrument under-performs when using informal enforcements as the endogenous variable.

environmental regulation leads to more contributions, although the estimated coefficients are smaller than in previous specifications and only significant at 10%. We also expect that if donors are following this type of strategy, they would contribute more to committees with influence over state environmental regulation. In the remainder of Table 18, I estimate the effect of CAA enforcement on contributions to Republicans in the environment, energy, and natural resources committees, respectively. I find no effect, casting doubt that donors are following a legislative strategy.

It is possible that special interests are still following a legislative strategy, but targeting those legislators who are more like-minded. Using CF scores data from Bonica (2018), I divide incumbent Republican candidates into quartiles according to their ideology, from most conservative to least conservative. The results in Table 19 in the Appendix show no effect for any group. Overall, I do not find evidence supporting a legislative strategy by firms facing increased regulatory burden.

If, on the other hand, firms are pursuing an electoral strategy, the expectation is that they would target different races. Using Klarner (2018) data on state electoral outcomes, I separate state electoral districts into three categories. Competitive districts are those in which Republicans received between 40% and 60% percent of the votes in the past k elections. Firms following an electoral strategy should target these races. If Republicans received less than 40% of the votes in the previous k elections, I consider these as safe democratic districts; while if Republicans received more than 60% of the votes in the previous k elections, I consider these as safe republican districts.

I present the results for competitive districts in Table 4. In Column 1, I find a positive and significant effect of regulation on contributions to Republican candidates. A 1% increase in the number of regulatory actions is associated with an increase of 0.36% in the amount of contributions. In this specification, I use $k = 1$, hence the competitiveness of the district is measured in the previous period. In Table 20 in the Appendix, I estimate the same model measuring vote shares for Republicans in the previous two, three, and four elections. Results are in the same direction as in Column 1, although the size of the effect and its significance get smaller as k increases, which is expected considering that elections many years ago could be less informative about the current level of competitiveness in a given district.

The previous result could be the result of more firms contributing in competitive districts because of increased environmental regulation, or by the same firms contributing more money. To shed light on these dynamics, I transform the dependent variable into a dummy indicator of contribution to state races. In other words, I code contributions as equal to one if a given firm made a contribution -regardless of its amount-, and zero otherwise. Results for $k = 1$ are shown in Column 2 of Table 4, while I relegate the other measures of competitiveness to Table 20 in the Appendix. Overall, results show that more firms are contributing to Republicans in competitive districts. In addition, in Table 21, I show that there is no consistent effect for contributions to Republican legislators or the number of Republican legislators targeted in safe districts, supporting the idea that donors are following an electoral strategy.

In Column 3 of Table 4, I also find a positive effect when using the number of Republican legislators in competitive districts to which firms give money. Finally, I construct a measure of contributions per legislator, dividing total contributions by the total number of legislators targeted. The amount of contributions to Republicans per legislator also increases as a result of increased regulation, as shown in Column 4.

Table 5 Competitive districts—prior democratic control

	(1) Contributions	(2) Contributor	(3) Num of Legislators	(4) Contribution per Legislator
Second stage				
Log(1+CAA)	0.800**	0.103**	0.152**	0.678**
	(0.334)	(0.043)	(0.065)	(0.282)
First Stage				
Fracking	0.212***	0.212***	0.212***	0.212***
	(0.054)	(0.054)	(0.054)	(0.054)
CD statistic	46.50	46.50	46.50	46.50
KP statistic	16.63	16.63	16.63	16.63
SY critical value	16.38	16.38	16.38	16.38
Mean DV	0.06	0.01	0.01	0.06
Firm/state FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	6931	6931	6931	6931
Firm/state	775	775	775	775

The analysis is restricted to Republican legislative candidates in competitive districts in Arkansas, Louisiana, Oklahoma, and West Virginia. The dependent variable in Column 1 is the amount of contributions in logs, a dummy which indicates if that particular firm/state contributed to these races in Column 2, the number of legislators donated to in Column 3, and the contribution per legislator in Column 4. *Log(1+CAA)* is the endogenous variable of interest. *Fracking* is the instrument, which takes the value of one if a given firm in a given state operates a facility in a zip code with fracking. The analysis is restricted to manufacturing firms. All specifications include firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. CD: Cragg-Donald, KP: Kleibergen-Paap, SY: Stock-Yogo. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

As a final extension, I divide my sample into two groups. On the first one, I include those states that had a consistent Democratic majority in the state House by the time the fracking revolution started. These states are Arkansas, Louisiana, Oklahoma, and West Virginia. If the motivation of SIGs is to change the composition of the legislature, we should expect to see a stronger effect for this group. The second group includes the states that had at least four years of Republican control of the state House by 2005: North Dakota, Pennsylvania, and Texas. I estimate similar specifications as in Table 4 for both groups. Results in Table 5 show that contributions from affected manufacturing firms increased for states that had a history of democratic control in the state House. On the other hand, as shown in 22, I find no effect for contributions in states with prior Republican control of the state House. These findings further support the idea that, faced with increased environmental regulation, interested groups increased their political participation to change the balance of the legislature, which controls the state environmental agencies.

8 Conclusion

Analyzing zip code-level data for the seven states in which the fracking boom occurred, I show that state environmental regulatory activities under the CAA for non-energy firms increased because of the new fracking industry. These spillover effects enable me to study

SIGs in the context of increased regulatory burden. Using the presence of fracking as an instrument, I show that state regulatory enforcement is associated with an increase in campaign contributions to Republicans in state races, in particular to legislative candidates. I find a positive result for legislative races, which is driven by the manufacturing sector. The results show that firms react to increased regulatory burden by increasing their contributions to legislative races in competitive districts, both at the extensive and intensive margin. Overall, these results provide important insights for future work on regulatory enforcement and the influence of special interests.

My results are consistent with firms trying to change the composition of the legislature, which is in charge of controlling how state environmental agencies conduct their work. Future research should focus on the mechanisms linking state politics and regulatory enforcement. Although there is a vast literature on political influence on the bureaucracy at the federal level, less is known about what happens at the state level and the specific mechanisms by which state politicians affect the monitoring of federal and state mandates.

Regulatory spillovers have important implications for far-reaching reforms, such as climate policy, and the implementation of new regulatory standards. I show that increases in regulatory costs directed at one sector have implications for the political behavior of other industries. To get a better picture of how private firms could react to changes in regulation, it is important to consider the wide economic effects that regulation aimed at one sector can have in other industries.

Appendix

See Tables 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 and 22.

Table 6 NAICS codes for energy-related industries

Code	Title
211120	Crude Petroleum Extraction
211130	Natural Gas Extraction
212230	Copper, Nickel, Lead, and Zinc Mining
213111	Drilling Oil and Gas Wells
213112	Support Activities for Oil and Gas Operations
221112	Fossil Fuel Electric Power Generation
221210	Natural Gas Distribution
324110	Petroleum Refineries
324121	Asphalt Paving Mixture and Block Manufacturing
324122	Asphalt Shingle and Coating Materials Manufacturing
324191	Petroleum Lubricating Oil and Grease Manufacturing
324199	All Other Petroleum and Coal Products Manufacturing
486110	Pipeline Transportation of Crude Oil
486210	Pipeline Transportation of Natural Gas
486910	Pipeline Transportation of Refined Petroleum Products
486990	All Other Pipeline Transportation

Table 7 Descriptive statistics—fracking and environmental enforcement

Variables	Obs	Mean	Std. Dev.	Min	Max
Zip code-level analysis					
Fracked	146,500	0.21	0.41	0	1
Fracking wells	146,500	0.80	11.30	0	1,070
State Action Non-energy	146,500	0.85	3.25	0	240
Regulated Facilities Non-energy	146,500	0.48	1.69	5	119
State Formal Enforcements	146,500	0.47	2.75	0	240
Establishments (county level)	143,275	7398	16,342	5	108,692
Employment (county level)	143,275	144,185	341,636	0	2,257,442
County level analysis					
Fracked	15,314	0.55	0.5	0	1
Fracking wells	15,314	5.08	44.81	0	1,543
Total employment	15,314	30,476	113,773	0	2,182,126
Energy-related employment	15,314	8445	32,694	0	692,310
Natural resources employment	15,314	667	2,922	0	94,792
Trade & transportation employment	15,314	6,224	23,885	0	452,160
Construction employment	15,314	1553	6717	0	159,051
Non-energy employment	15,314	35,419	142,566	0	2,663,836
Manufacturing employment	15,314	3591	11,917	0	194,564
Professional employment	15,314	3220	17,287	0	371,772
Leisure employment	15,314	2780	10,293	0	199,401
Education employment	15,314	3954	14,504	0	261,667

Table 8 Fracking and energy-related employment—county level

	Employment, in logs				
	(1)	(2)	(3)	(4)	(5)
	Total	Fracking Related	Natural Resources	Trade & Transport	Construction
Fracked x	0.075***	0.076**	0.172**	0.031	0.052
Post-2005	(0.017)	(0.031)	(0.081)	(0.028)	(0.091)
Mean DV	9.615	7.553	5.082	7.149	4.986
County FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	15,314	15,314	15,314	15,314	15,314
Counties	639	639	639	639	639

The analysis is restricted to oil-related industries and the unit of analysis is the county/year. Dependent variables measure employment in different industries (in logs). The variable *Fracked* * *Post-2005* is the difference-in-differences estimate. All specifications include county and year fixed effects. Standard errors are clustered at the county level. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 9 Fracking and non-energy-related employment—county level

	Employment, in logs				
	(1)	(2)	(3)	(4)	(5)
	Non-fracking related	Manufacturing	Professional	Leisure	Education
Fracked x	0.020	0.130	0.007	0.015	−0.017
Post-2005	(0.024)	(0.091)	(0.075)	(0.044)	(0.053)
Mean DV	8.672	5.703	5.106	6.047	6.306
County FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	15,314	15,314	15,314	15,314	15,314
Counties	639	639	639	639	639

The analysis is restricted to non-energy-related industries and the unit of analysis is the county/year. Dependent variables measure employment in different industries. The variable *Fracked * Post-2005* is the difference-in-differences estimate. All specifications include county and year fixed effects. Standard errors are clustered at the county level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p<0.1$

Table 10 Fracking and toxic emissions

	Emissions, in logs			CAA regulated, in logs		
	(1)	(2)	(3)	(4)	(5)	(6)
	Fugitive	Stack	Total	Fugitive	Stack	Total
Fracked x	− 0.010	0.024	− 0.021	0.044	0.016	0.025
Post-2005	(0.081)	(0.079)	(0.077)	(0.073)	(0.077)	(0.074)
Mean DV	3.50	3.88	5.02	2.74	3.22	4.04
Facility FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56,233	56,233	56,233	56,233	56,233	56,233
Facilities	6736	6736	6736	6736	6736	6736

Dependent variables measured in pounds. The variable *Fracked * Post-2005* is the difference-in-differences estimate. All specifications include facility and year fixed effects. Standard errors are clustered at the facility level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 11 Environmental complaints

	(1) Complaints	(2) Complaints
Fracked x	9.384***	11.474***
Post-2005	(2.729)	(3.322)
Mean DV	10.53	10.53
Controls	No	Yes
County FE	Yes	Yes
Year FE	Yes	Yes
Observations	660	660
Counties	66	66

Dependent variable is the number of oil-related environmental complaints. The analysis is restricted to counties in Pennsylvania. The variable *Fracked * Post-2005* is the difference-in-differences estimate. Controls include the log of total employment and the log of total establishments. All specifications include county and year fixed effects. Standard errors are clustered at the county level. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 12 Descriptive statistics—environmental enforcement and campaign contributions

Variables	Obs	Mean	Std. Dev	Min	Max
State Contributions	22,130	1,070	15,663	-9,520	751,963
Contributions to Governor	22,130	178	3,388	0	245,013
Contributions to Legislature	22,130	893	13,609	-71,524	596,014
State Contributions (R)	22,130	772	12,861	-20,366	697,195
Contributions to Governor (R)	22,130	133	3,119	0	245,013
Contributions to Legislature(R)	22,130	639	11,117	-81,968	568,174
State Contributions (D)	22,130	297	3,798	0	183,434
Contributions to Governor (D)	22,130	44	965	0	72,806
Contributions to Legislature (D)	22,130	253	3,314	0	145,690
Fracking	22,130	0.06	0.25	0	1
State Action Non-energy	22,130	2.97	16.53	0	685
Lobbying Spending	22,130	346,834	2,673,901	0	64,000,000
Contributions to Congress	22,130	530	5,271	-726	187,662
Contributions to Congress (R)	22,130	369	3,768	-726	145,902
Contributions to Congress (D)	22,130	158	1,817	-726	77,849
Contributions R (competitive, $k = 1$)	18,228	60	1,820	-109,109	137,976
Contributions R (competitive, $k = 2$)	18,228	60	1,490	0	146,661
Contributions R (competitive, $k = 3$)	18,228	45	876	0	51,555
Contributions R (competitive, $k = 4$)	18,228	40	739	0	39,182
Contributor (competitive, $k = 1$)	18,228	0.01	0.10	0	1
Num of legislators (competitive, $k = 1$)	18,228	0.04	0.56	0	26
Num of legislators (competitive, $k = 2$)	18,228	03	0.47	0	22
Num of legislators (competitive, $k = 3$)	18,228	03	0.39	0	15
Num of legislators (competitive, $k = 4$)	18,228	0.03	0.36	9	13
Contribution per legislator	18,228	11	260	-21,822	13,798
Ideology (quartile 1)	18,228	112	2,555	0	185,676
Ideology (quartile 2)	18,228	120	2,078	-372	124,249
Ideology (quartile 3)	18,228	187	3,259	0	178,151
Ideology (quartile 4)	18,228	203	3,409	-108,295	179,873
Contribution Incumbent	18,228	872	12,970	-79,851	551,094
Contributor Incumbent	18,228	0.02	0.15	0	1
Num of legislators (Inc)	18,228	0.29	3.17	0	102
Environment committee	18,228	43	899	0	55,369
Nat res committee	18,228	29	613	0	39,584
Energy committee	18,228	47	1,025	0	70,115
Contribution (safe R $k = 1$)	18,228	281	6,196	0	459,171
Contribution (safe R $k = 2$)	18,228	347	6,951	-100,967	460,271
Contribution (safe R $k = 3$)	18,228	355	7,306	-99,881	463,405
Contribution (safe D $k = 1$)	18,228	88	3,194	0	306,239
Contribution (safe D $k = 2$)	18,228	22	437	0	24,747
Contribution (safe D $k = 3$)	18,228	29	518	0	26,318

Table 13 Environmental enforcement and campaign contributions—OLS

	Campaign contributions, in logs		
	(1)	(2)	(3)
	Total	Republican	Democratic
Log(1+CAA)	0.021	0.018	0.011
	(0.015)	(0.014)	(0.013)
Mean DV	0.28	0.24	0.21
Firm/state FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	20,142	20,142	20,142
Firm/state	2258	2258	2258

Dependent variables are in logs. All specifications include firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. ***$p<0.01$, **$p < 0.05$, *$p < 0.1$

Table 14 State environmental enforcement and federal contributions

	Campaign contributions, in logs		
	(1)	(2)	(3)
	Total	Republican	Democratic
Second stage			
Log(1+CAA)	− 0.007	0.002	− 0.021
	(0.236)	(0.227)	(0.171)
First Stage			
Fracking	0.271***	0.271***	0.271***
	(0.043)	(0.043)	(0.043)
CD statistic	115.19	115.19	115.19
KP statistic	39.58	39.58	39.58
SY critical value	16.38	16.38	16.38
Mean DV	0.272	0.238	0.168
Firm/state FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	21,342	21,342	21,342
Firm/state	2392	2392	2392

All dependent variables are in logs. *Log(1+CAA)* is the endogenous variable of interest. *Fracking* is the instrument, which takes the value of one if a given firm in a given state operates a facility in a zip code with fracking. All specifications include firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. CD: Cragg-Donald, KP: Kleibergen-Paap, SY: Stock-Yogo. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 15 Environmental enforcement and campaign contributions—with covariates

	Campaign contributions, in logs		
	(1)	(2)	(3)
	Total	Republican	Democratic
Second stage			
Log(1+CAA)	0.522**	0.512**	0.194
	(0.235)	(0.236)	(0.202)
Log(1+Lobby)	0.042***	0.033***	0.040
	(0.008)	(0.008)	(0.008)
First Stage			
Fracking	0.245***	0.245***	0.245***
	(0.045)	(0.045)	(0.045)
CD statistic	88.07	88.07	88.07
KP statistic	29.72	29.72	29.72
SY critical value	16.38	16.38	16.38
Mean DV	0.28	0.24	0.21
Firm/state FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	20,142	20,142	20,142
Firm/state	2258	2258	2258

All dependent variables are in logs. *Log(1+CAA)* is the endogenous variable of interest. *Fracking* is the instrument, which takes the value of one if a given firm in a given state operates a facility in a zip code with fracking. All specifications include the log of total federal lobbying spending as a control, as well as firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. CD: Cragg-Donald, KP: Kleibergen-Paap, SY: Stock-Yogo. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 16 Regulatory enforcement on non-manufacturing firms

	Campaign contributions, in logs						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Total	Republican	Republican governor	Republican legislative	Democrat	Democrat governor	Democrat legislative
Second stage							
Log(1+CAA)	− 0.125	− 0.138	− 0.366	− 0.256	− 0.432	0.803	− 0.674
	(0.930)	(1.042)	(0.454)	(1.164)	(1.110)	(0.960)	(1.335)
First Stage							
Fracking	0.152	0.152	0.152	0.152	0.152	0.152	0.152
	(0.119)	(0.119)	(0.119)	(0.119)	(0.119)	(0.119)	(0.119)
CD statistic	4.72	4.72	4.72	4.72	4.72	4.72	4.72
KP statistic	1.64	1.64	1.64	1.64	1.64	1.64	1.64
SY critical value	16.38	16.38	16.38	16.38	16.38	16.38	16.38
Mean DV	0.21	0.18	0.07	0.17	0.16	0.06	0.15
Firm/state FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2747	2747	2747	2747	2747	2747	2747
Firm/state	310	310	310	310	310	310	310

All dependent variables are in logs. *Log(1+CAA)* is the endogenous variable of interest. *Fracking* is the instrument, which takes the value of one if a given firm in a given state operates a facility in a zip code with fracking. The analysis is restricted to non-manufacturing firms. All specifications include firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. CD: Cragg-Donald, KP: Kleibergen-Paap, SY: Stock-Yogo. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 17 Informal enforcement

	Campaign contributions, in logs		
	(1)	(2)	(3)
	Total	Republican	Democratic
Second stage			
Log(1+CAA)	− 3.072	− 0.912	− 0.046
	(1.948)	(0.842)	(0.582)
First Stage			
Fracking	− 0.052**	− 0.052**	− 0.052**
	(0.025)	(0.025)	(0.025)
CD statistic	7.41	7.41	7.41
KP statistic	4.24	4.24	4.24
SY critical value	16.38	16.38	16.38
Mean DV	0.29	0.11	0.06
Firm/state FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	17,395	17,395	17,395
Firm/state	1948	1948	1948

All dependent variables represent contributions to gubernatorial races. *Log(1+CAA)* is the endogenous variable of interest which measures informal regulatory activities. *Fracking* is the instrument, which takes the value of one if a given firm in a given state operates a facility in a zip code with fracking. All specifications include firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. CD: Cragg-Donald, KP: Kleibergen-Paap, SY: Stock-Yogo. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 18 Contributions to republican incumbents in legislative races

	All incumbents	In related committees		
	(1)	(2)	(3)	(4)
	Contributions	Environment	Energy	Natural resources
Second stage				
Log(1+CAA)	0.369*	− 0.048	0.152	− 0.119
	(0.197)	(0.127)	(0.141)	(0.111)
First stage				
Fracking	0.257***	0.257***	0.257***	0.257***
	(0.048)	(0.048)	(0.048)	(0.048)
CD statistic	83.37	83.37	83.37	83.37
KP statistic	28.14	28.14	28.14	28.14
SY critical value	16.38	16.38	16.38	16.38
Mean DV	0.23	0.07	0.07	0.07
Firm/state FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	17,395	17,395	17,395	17,395
Firm/state	1948	1948	1948	1948

The dependent variable in Column 1 is the amount of contributions to incumbent legislators, while Columns 4 to 6 measure contributions to legislators in environmental, energy, and natural resources committees, respectively. *Log(1+CAA)* is the endogenous variable of interest. *Fracking* is the instrument, which takes the value of one if a given firm in a given state operates a facility in a zip code with fracking. The analysis is restricted to manufacturing firms. All specifications include firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. CD: Cragg-Donald, KP: Kleibergen-Paap, SY: Stock-Yogo. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 19 Conditional effects on incumbent legislators' ideology

	Campaign contributions, in logs			
	(1)	(2)	(3)	(4)
	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile
Second stage				
Log(1+CAA)	0.186	0.164	0.223	0.289*
	(0.126)	(0.185)	(0.147)	(0.172)
First Stage				
Fracking	0.257***	0.257***	0.257***	0.257***
	(0.048)	(0.048)	(0.048)	(0.048)
CD statistic	83.36	83.36	83.36	83.36
KP statistic	28.14	28.14	28.14	28.14
SY critical value	16.38	16.38	16.38	16.38
Mean DV	0.11	0.13	0.15	0.15
Firm/state FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	17,396	17,396	17,396	17,396
Firm/state	1948	1948	1948	1948

All dependent variables in logs. Contributions are divided from most conservative (Column 1) to least conservative (Column 4). *Log(1+CAA)* is the endogenous variable of interest. *Fracking* is the instrument, which takes the value of one if a given firm in a given state operates a facility in a zip code with fracking. The analysis is restricted to manufacturing firms. All specifications include firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. CD: Cragg-Donald, KP: Kleibergen-Paap, SY: Stock-Yogo. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 20 Contributions to republicans in competitive districts—extensions

	Contributions, in logs			Number of legislators, in logs		
	(1)	(2)	(3)	(4)	(5)	(6)
	$k = 2$	$k = 3$	$k = 4$	$k = 2$	$k = 3$	$k = 4$
Second stage						
Log(1+CAA)	0.429**	0.378**	0.230	0.073**	0.048*	0.025
	(0.177)	(0.166)	(0.155)	(0.032)	(0.028)	(0.024)
First Stage						
Fracking	0.257***	0.257***	0.257***	0.257***	0.257***	0.257***
	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)
CD statistic	83.36	83.36	83.36	83.36	83.36	83.36
KP statistic	28.14	28.14	28.14	28.14	28.14	28.14
SY critical value	16.38	16.38	16.38	16.38	16.38	16.38
Mean DV	0.09	0.09	0.09	0.01	0.01	0.01
Firm/state FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,396	17,396	17,396	17,396	17,396	17,396
Firm/state	1948	1948	1948	1948	1948	1948

The dependent variable in all specifications is contributions to Republican candidates in competitive races. k indicates the number of previous elections used to calculate the competitiveness of the district. *Log(1+CAA)* is the endogenous variable of interest. *Fracking* is the instrument, which takes the value of one if a given firm in a given state operates a facility in a zip code with fracking. The analysis is restricted to manufacturing firms. All specifications include firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. CD: Cragg-Donald, KP: Kleibergen-Paap, SY: Stock-Yogo. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 21 Contributions to republicans in non-competitive districts

	Safe red districts			Safe blue districts		
	(1)	(2)	(3)	(4)	(5)	(6)
	$k = 1$	$k = 2$	$k = 3$	$k = 1$	$k = 2$	$k = 3$
Second stage						
Log(1+CAA)	0.301	0.320	0.319	0.110	0.169	0.170
	(0.191)	(0.206)	(0.203)	(0.078)	(0.165)	(0.160)
First Stage						
Fracking	0.257***	0.257***	0.257***	0.257***	0.257***	0.257***
	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)
CD statistic	83.36	83.36	83.36	83.36	83.36	83.36
KP statistic	28.14	28.14	28.14	28.14	28.14	28.14
SY critical value	16.38	16.38	16.38	16.38	16.38	16.38
Mean DV	0.13	0.16	0.16	0.02	0.06	0.07
Firm/state FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,396	17,396	17,396	17,396	17,396	17,396
Firm/state	1948	1948	1948	1948	1948	1948

The dependent variable in all specifications is contributions to Republican candidates. The analysis is restricted to Republican legislative candidates in non-competitive districts. k indicates the number of previous elections used to calculate the competitiveness of the district. *Log(1+CAA)* is the endogenous variable of interest. *Fracking* is the instrument, which takes the value of one if a given firm in a given state operates a facility in a zip code with fracking. The analysis is restricted to manufacturing firms. All specifications include firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. CD: Cragg-Donald, KP: Kleibergen-Paap, SY: Stock-Yogo. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 22 Competitive districts—prior republican control

	(1) Contributions	(2) Contributor	(3) Num of legislators	(4) Contribution per legislator
Second stage				
Log(1+CAA)	0.204	0.016	0.060	0.142
	(0.181)	(0.020)	(0.046)	(0.145)
First Stage				
Fracking	0.222***	0.222***	0.222***	0.222***
	(0.070)	(0.)	(0.)	(0.)
CD statistic	31.11	31.11	31.11	31.11
KP statistic	10.10	10.10	10.10	10.10
SY critical value	16.38	16.38	16.38	16.38
Mean DV	0.09	0.01	0.02	0.08
Firm/state FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	10,464	10,464	10,464	10,464
Firm/state	1173	1173	1173	1173

The analysis is restricted to Republican legislative candidates in competitive districts in North Dakota, Pennsylvania, and Texas. The dependent variable in Column 1 is the amount of contributions in logs, a dummy which indicates if that particular firm/state contributed to these races in Column 2, the number of legislators donated to in Column 3, and the contribution per legislator in Column 4. *Log(1+CAA)* is the endogenous variable of interest. *Fracking* is the instrument, which takes the value of one if a given firm in a given state operates a facility in a zip code with fracking. The analysis is restricted to manufacturing firms. All specifications include firm/state and cycle fixed effects. Standard errors are clustered at the firm/state level. CD: Cragg-Donald, KP: Kleibergen-Paap, SY: Stock-Yogo. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

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Data availability Data repository: https://doi.org/10.7910/DVN/YAKNGP (Harvard Dataverse)

Declarations

Conflict of interest I have no Conflict of interest to disclose.

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