Does Private Equity Ownership Make Firms Cleaner? The Role Of Environmental Liability Risks

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Abstract

This paper shows that private equity (PE) ownership reduces pollution when the target company faces high environmental enforcement or political risks. Conversely, PE-backed firms increase pollution when environmental liability risks are low, as shown by a novel natural experiment that reduced these risks for projects located on Native American land. Exploiting specific private equity deals within the energy industry, I find that PE governance mainly drove the results. Overall, maximizing shareholder value may benefit environmental outcomes when the potential liabilities of polluting are high.

Keywords: Private equity, environmental externalities, Sustainable finance

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July 17, 2022

Abstract

This paper shows that private equity (PE) ownership reduces pollution when the target company faces high environmental enforcement or political risks. Conversely, PE-backed firms increase pollution when environmental liability risks are low, as shown by a novel natural experiment that reduced these risks for projects located on Native American land. Exploiting specific private equity deals within the energy industry, I find that PE governance mainly drove the results. Overall, maximizing shareholder value may benefit environmental outcomes when the potential liabilities of polluting are high.

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Private equity buyouts lead to operational changes that, on average, significantly increase the shareholder value of their target companies (Kaplan (1989), Boucly, Sraer, and Thesmar (2011), Davis et al. (2014), Johnston-Ross, Ma, and Puri (2021)). However, whether PE buyouts create shareholder value at the expense of other stakeholders is unclear empirically, as previous works reach conflicting conclusions. For instance, PE ownership leads to a reduction in food poisoning (Bernstein and Sheen (2016)) and worker hazards (Cohn, Nestoriak, and Wardlaw (2019)). Yet, PE-backed firms also offer lower-quality services in the nursing home (Gupta et al. (2020)) and educational sectors (Eaton, Howell, and Yannelis (2019)).

In this paper, I show that a critical dimension for understanding the conflicting impact of PE buyouts on stakeholders is the level of legal liability the target company faces if the company hurts stakeholders' welfare. Firms are exposed to low liabilities when such rules are not perfectly enforced, when their stakeholders face friction(s) to litigate, or when the current or future regulation is low. If a firm is subject to more liability and legal rules, then it becomes optimal not to invest in projects subject to these liability costs. These projects are less likely to be realized by PE-backed firms, given that they have *higher powered incentives* to maximize expected profit compared to other forms of ownership.[1] Therefore, PE equity ownership benefits (harm) stakeholders when the liabilities that face their portfolio companies are high (low).

I provide evidence for this mechanism by studying the pollution released by firms in the US oil and gas industry. Focusing on this empirical setting offers several advantages. First, it allows me to use novel high-frequency project-level data on corporate environmental policies. Specifically, I merge administrative data on the chemicals used in the production process for 166,279 US wells fracked between 2010 and 2021 with detailed information on the characteristics of each well. The granularity of the data allows me to control for different time trends

[1] A PE sponsor provides a form of ownership that better aligns the incentives of owners with corporate managers (Jensen (1989), Gompers, Kaplan, and Mukharlyamov (2016), Morris and Phalippou (2020)). The use of greater debt disciplines managers, and PE firms increase managerial incentives to maximize profit through performance-based pay or better management practices (Bloom, Sadun, and Van Reenen (2015)). On behalf of limited partners, general partners, control the board of their portfolio companies and actively monitor them. Moreover, general partners rarely have any personal connections to local communities that could interfere with pollution decisions.

at the *hyper-local* area level. These controls absorb salient differences between projects from PE-backed and non-PE-backed firms. Using geographical variables to control for unobserved differences in technology or productivity between projects is a common approach in the literature that uses the fracking industry as an empirical setting (Gilje and Taillard (2015), Gilje, Loutskina, and Murphy (2020)).

Second, I exploit the geographical heterogeneity in environmental liabilities to which oil and gas firms are exposed to evaluate the influence of these liabilities on PE-backed firms. Firms in the oil and gas industry are subject to different environmental liability risks, which vary over time and space. One notable advantage of having within-firms variations in environmental liability risks is that it allows for the inclusion of a firm-year fixed effect. This fixed effect mitigates the influence of omitted variables that could affect both the decision of a PE firm to acquire a company and the decision of this acquired company to pollute. This firm-year fixed effect also ensures that the change in pollution is not an unintended effect of adopting new technology or other firm-level operational changes.

I start the analysis by documenting how PE-backed firms reduce the relative usage of toxic chemicals for projects located in states with high environmental liability risks. I use two measures for these risks. First, I borrow from the political science literature to compute an enforcement risk measure (Konisky (2007)). Second, I rely on whether the constituents in the state select the Democratic party more often when voting. Recent research suggests that Democratic states implement higher environmental enforcement actions and regulations (Bisetti, Lewellen, and Sarkar (2021), Chu et al. (2021), and Gormley, Kaviani, and Maleki (2021)). Using these two measures, I show that PE ownership leads to a relative reduction in pollution by 24.8% if the project is located in a state with an enforcement risk that is above the sample median average and by 52.2% if the project is located in a state where a majority of voters support the Democratic party. These results are shown after controlling for project-level time-varying characteristics, such as the production and the technology of the projects, and any firm-level or hyper-local specific unobserved heterogeneity.

I do not observe any effect on pollution for high enforcement places when the PE firm provides equity financing to a company without having the ability to control the management team. To show this result, I rely on a type of PE deal that exists only in the oil and gas industry: DrillCo contracts. To my knowledge, this paper is the first to document and exploit this class of PE contracts. In such contracts, the PE firm provides capital for projects in exchange for cash flow rights from these projects. Interestingly for my empirical design, the PE firm does not control the firm's management in a DrillCo. When replicating the specifications used for the buyout results, I show that firms do not reduce pollution in high environmental risk states when the PE sponsor cannot control their portfolio companies—as when a DrillCo agreement is in place.

Although the previous results are informative, I cannot rule out the possibility of selection bias between PE ownership and pollution as well as environmental liability risks. To better validate the interpretation that PE-backed firms are more responsive to legal changes regarding the liabilities they faces, I next exploit plausibly exogenous changes in the environmental liability risks that face projects located in some areas. Specifically, I exploit a succession of legal and political shocks that blocked the ability of the Bureau of Land Management (BLM) to regulate fracking on Native American reservations and federal lands between 2016 and 2018. Fracking has been exempted from federal environmental statutes since 2005. However, in 2015, the BLM passed a rule under the Obama Administration that would have imposed a comprehensive set of requirements to curtail fracking activity. The ruling never went into effect because it was challenged in court and blocked by a federal district court judge in Wyoming in 2016. The Trump administration then rescinded the rule entirely in 2017. Subsequently, in 2018, environmental activists and the state of California challenged this decision, as the rescission was not economically motivated, contrary to the legal obligations of federal agencies. This court challenge increased the probability that the BLM would regulate fracking increased after 2018. Therefore, between 2016 and 2018, there was a low probability of new regulations in Native American reservations and federal lands.

The exogeneity assumption of the regulation shock to unobserved variables affecting the cost of pollution is credible. The boundaries of Native American reservations and federal lands were decided at the end of the nineteenth and the beginning of the twentieth centuries and overlap shale basins in a quasi-random way, as horizontal drilling and hydraulic fracturing were not widely used until the beginning of the twenty-first century. This quasi-random overlapping of shale boundaries and BLM areas is supported by the balance in most characteristics before 2015 for projects around the borders of areas regulated by the BLM.

Using this empirical design, I show that projects from PE-backed firms in areas with lower regulation risks contained more toxic pollution than other projects from PE-backed firms in areas with no changes to regulatory risks. The relative increase in pollution following the regulation shock is quantitatively large, equivalent to an increase of 39.87% in the usage of pollution.

To support these results, I run several robustness tests. First, I show that the effect is not driven by strategic reporting, as the results are robust to controlling in a flexible way for the number of confidential items reported. Second, I construct a matched sample and find similar results. Third, I report the coefficients from 768 different regressions that explore all the possible combinations of controls and fixed effects to transparently show how a specific set of controls affects the results, similar to the specification curves of Simonsohn, Simmons, and Nelson (2019), Cookson (2018), and Akey, Heimer, and Lewellen (2021). The conclusion of the specification curves suggests that the results are economically robust across a wide range of empirical specifications.

Overall, the results of this paper support the view that the PE investment model creates shareholder value in part by altering the governance of the target company. PE-backed firms have high-powered incentives and means to maximize profit compared to both publicly-listed and closely-held private firms. Compared to a publicly-listed company, the managers of a PE-backed firm are less entrenched (Jensen (1989), Gompers, Kaplan, and Mukharlyamov (2016), Morris and Phalippou (2020)). Managerial entrenchment creates an incentive to maximize short-term value at the expense of long-term value (Stein (1989), Grenadier and Malenko

(2011)). One way to increase short-term value is to increase long-term legal costs by increasing current pollution and saving the immediate abatement cost. Moreover, compared to privately-held companies, PE-backed firms face fewer financial constraints (Malenko and Malenko (2015)) that hinder the investments in abatement technology (Kim and Xu (2017)). They also possess more significant legal knowledge, and the general partners have ample industrial experience (Bernstein and Sheen (2016)). As a result, PE-backed firms more substantial incentives than other privately-held companies to reduce pollution when environmental liability risks increase.

This paper's findings offer a way to unify the a priori conflicting results of the extant literature on the externalities of private equity ownership. PE ownership benefits other stakeholders for tasks or industries with large liability risks that are highly regulated. In particular, they improve restaurants' health standards (Bernstein and Sheen (2016)) and worker hazards (Cohn, Nestoriak, and Wardlaw (2019)). When a consumer experiences food poisoning or a worker is injured at work, they possess a well-identified tort claim against the company that created the harm. This liability penalizes firm profits and discipline the firm ex ante behavior. Such forces are less prevalent in historically non-profit and opaque industries, such as the health care (Gupta et al. (2020)) and education (Eaton, Howell, and Yannelis (2019)) sectors, where PE ownership leads to worse outcomes for stakeholders. Overall, the results of this paper suggest that the amount of liabilities a firm is exposed to can help us understand whether PE ownership causes operational changes that benefit society. It also suggests that policy and public debates should focus less on whether PE buyouts should be allowed and more on whether the current legal system and enforcement practices protect stakeholders' interests when private equity buyouts occur.

This paper also contributes to the literature on the externalities of private equity ownership by studying the impact of PE ownership on the persons exposed to the cost of pollution.[2] The

[2]Other factors affecting pollution decisions include other financial investors (Akey and Appel (2019), Dyck et al. (2019), Naaraayanan, Sachdeva, and Sharma (2019), Chu and Zhao (2019)), supply chains (Schiller (2018)), CEO preferences (Di Giuli and Kostovetsky (2014), Li, Xu, and Zhu (2021)), financial constraints (Kim and Xu

extent to which PE firms affect the environmental practices of their target companies have come under recent attention in the public sphere. For instance, in the United States, some members of Congress have expressed concern that "the private equity industry poses significant threats to international environmental protections and efforts to combat global climate change."[3] However, most academic papers focus exclusively on the operational consequences of PE ownership for consumers, workers, and governments. The exception is Shive and Forster (2019), who study the impact of listing status on environmental externalities, albeit in an empirical setting that differes from this paper, and show that PE ownership is associated with an increase or no effect on pollution. The advantage of my empirical setting is the ability to control almost perfectly for production and technology, to conduct the econometric analysis at a high frequency and a highly disaggregated level, and to observe pollution decisions for all firms in my sample. Interpreting their results with the mechanism in this paper suggests that environmental regulation risk was not prevalent in the US during the timeframe of their study.

This paper complements survey-level evidence on why financial investors engage with their portfolio companies on corporate environmental policies. Publicly-listed firms that have high ESG performance are less exposed to risks (Godfrey, Merrill, and Hansen (2009), Oikonomou, Brooks, and Pavelin (2012), Jo and Na (2012), Kim, Li, and Li (2014), Hoepner et al. (2018), Ilhan, Sautner, and Vilkov (2021), Albuquerque, Koskinen, and Zhang (2019)). Similarly, Krueger, Sautner, and Starks (2020) show in a survey that institutional investors report that managing environmental risks is the main reason they engage with their portfolio firms. My paper complements this literature by focusing on another class of investors—private equity firms. It shows that PE investors negatively affect environmental outcomes when environmental regulation risks are low, supporting a risk-based channel of environmental engagement by private financial investors.

(2017), Cohn and Deryugina (2018), Bartram, Hou, and Kim (2019), De Haas and Popov (2019), Levine et al. (2019), Bartram, Hou, and Kim (2019)), and competition (Grinstein and Larkin (2020)).

[3]Elizabeth Warren, Mark Pocan, Raúl M. Grijalva, Deb Haaland, Rashida Tlaib, Jesús G. "Chu" García, and Sheldon Whitehouse (December 16, 2019).

The remainder of the paper is organized as follows. Section 1 provides the institutional background of the empirical setting and section 2 describes and validates the datasets used. Section 3 details the empirical strategy used in the paper. Section 4 provides the main result that PE ownership leads to a reduction (increase) of pollution when environmental liability risks are high (low), and performs several robustness tests. Finally, section 5 concludes.

1 Institutional Background

This section presents the specificities of the oil and gas industry that are important to understand for the empirical design. Namely, subsection 1.1 shows how shale gas and oil operators produce pollution and why this pollution is important for regulators and firms. Then subsection 1.2 describes the regulation of the fracking industry. Finally, subsection 1.3 exposes the type and nature of PE contracts specific to the oil and gas industry.

1.1 Shale oil and gas drilling and pollution

The production of natural gas in the United States increased by more than 25% from 2007 to 2013, and the production of oil nearly doubled between 2009 (5.4 Mb/d million barrels of oil per day) and 2014 (9.4 Mb/d at year-end 2014), following the discovery of hydraulic fracturing and horizontal drilling.[4] Horizontal drilling allows the exploitation of reserves located in a horizontal reservoir and that could not be exploited with a traditional vertical well. Hydraulic fracturing is the practice of creating cracks in the rock so that gas and oil can circulate to the well for subsequent extraction. These cracks are made by injecting high-pressure water mixed with different chemical components, technologies that enable the exploitation of large, untapped reserves of hydrocarbons captured in porous and low-permeability rocks.

There are multiples ways through which the extraction of oil and gas, especially through hydraulic fracturing, generates pollution. The fracturing process is conducted using chemicals that

[4] Oil production from fracked wells accounts for nearly half of US production (EIA (2017)).

can be highly toxic for humans. For instance, proppants are injected to ensure that the fractures remain open and to create a high-conductivity pathway so that the hydrocarbons can easily reach the surface. Anti-bacterial agents are included in the fracking mix to reduce bioclogging and corrosion. A clay stabilizer is added so that the clay does not swell. Other toxic chemicals can be included depending on the situation. These components can come into contact with humans and ecosystems, either by groundwater contamination, flaring, or leaks from storage tanks.
Oil and gas activities also generate pollution by flaring, which consists of burning the gas contained in oil wells instead of recovering it. The gas that is burnt allows the firm to avoid investing in infrastructure —such as connecting the well to a pipeline— that would allow its exploitation. The burnt gas can disperse toxic chemicals to the neighborhood, thus contaminating the air.

Toxic chemicals used by fracking firms affect the welfare of local residents. A wealth of evidence suggests that this pollution affects the health of people living close to wells, which is reflected in the reduced demand for houses close to fracking areas. To date, these toxic pollutants have been exposed to 18 million households that live at least one mile from a well (Konkel (2017)). This number will grow as US onshore production expands. According to the 2010 decennial census, more than 55 million households live in a shale basin and thus risk exposure to toxic chemicals. Toxic releases from fracking activities, as recognised for instance by the Center for biological diversity, threaten plants, wildlife, and the sustainability of ecosystems.

1.2 The regulation of pollution in the US oil and gas industry

The release of toxic components in natural surface waters —such as lakes, rivers, streams, wetlands, and coastal areas— is controlled in the United States by the Clean Water Act (CWA), and the Safe Drinking Water Act (SDWA). The regulation of toxic waste and the handle of cleanup is managed by the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The practice of hydraulic fracturing has been exempt from the SDWA, and from important permitting and pollution control requirements included in the CWA since the Energy Policy Act of 2005. The industry is also exempt from CERCLA and RCRA liabilities following a contamination, as long as the contamination is not caused by fracking chemicals.[5]

The highly controversial exemption is based on the idea that fracking does not affect local communities.[6] I exploit these exemptions in my empirical analysis to define a variable of over-compliance. I select chemicals that are reported as toxic and hazardous for human health, in the United States House of Representatives Committee on Energy and Commerce report from April 2011. Health scientists agree on the high degree of toxicity of these chemicals, and anecdotal stories of local contamination due to these components have been reported. As a result, these chemicals have a high media exposure and have been reported by several environmental organizations as threatening human health. With one exception, all these chemicals are all regulated by the SDWA and CAA but subject to the fracking industry exemption. Table 1 reports the names of all the chemicals used in the analysis, as well as their CASN number and whether they are regulated by SDWA and CAA.

The extent to which this exemption applies to the Bureau of land management (BLM) has been the subject of an ongoing legal dispute. The BLM, a federal agency within the US Department of the Interior, is responsible for the environmental regulation of federal land and Native American reservations and oversees one-eighth of the land in the continental United States. Its core mission is "to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations." Within its scope of work, the BLM super-

[5] This exemption does not apply to diesel fuels from hydraulic fracturing.

[6] In 1997, the Environmental Protection Agency (EPA) was ordered by a decision from the US Court of Appeals of the 11th Circuit to include hydraulic fracturing in the SDWA. In 2001, a special task force led by Vice President Dick Cheney asked that Congress exempt hydraulic fracturing from the SDWA. Then, the EPA released a controversial report in 2004 claiming that hydraulic fracturing "poses little or no threat" to drinking water. As a result, the 2005 energy bill withdrew the ability of the EPA to regulate hydraulic fracturing activities. This exemption was highly controversial. In March of 2005, evidence of potential mishandling in the EPA study of 2004 was officially found. Moreover, the Oil and Gas Accountability Project (OGAP) organized a review of the 2004 report and found proof that the EPA removed from the initial drafts any section that suggested unregulated fracturing could be detrimental to human health. Subsquent research and anecdotal evidence support the view that fracking activities can be detrimental to human health and ecosystems (Bonetti, Leuz, and Michelon (2021)).

vises the leasing of oil and gas reserves and provides technical advice for drilling operations on Native American reservations.

In appendix 5, I provide more additional details on the legal dispute regarding the ability of the BLM to regulate fracking, which I summarize here. In 2012, the BLM started drafting a regulation to reduce the negative externalities caused by hydraulic fracturing. The regulation was supposed to go into effect on June 24, 2015. On March 20, 2015, various petitioners filed a motion for a preliminary injunction to challenge the fracking rule.[7] The preliminary injunction was granted by the Federal Court of the 10th Circuit, which found that "BLM did not have the authority to regulate fracking" (Williams (2015)). The rule was abrogated in 2016 by the District of Wyoming.

On January 20, 2017, former-President Donald Trump was inaugurated and changed the political orientation of the BLM, which withdrew its support for the fracking rule. An Interior Department Assistant Secretary stated that an "initial review has revealed that the 2015 Rule does not reflect... the current Administration's policies and priorities concerning the regulation of hydraulic fracturing on Federal and Indian lands."

Following this rescission, the state of California and a group of environmental activists sued the BLM on January 24, 2018, for voiding the fracking rule, because the Administrative Procedure Act requires that any agency that decides to change its policy should explain why the new policy is better. These details were absent from the decision. As a result, it was highly likely that the BLM could not regulate fracking between 2016 and 2018.

1.3 Private equity in the oil and gas industry

Several features of the oil and gas industry make it attractive for PE investment. First, this industry is a capital-intensive sector. For instance, in 2009, the median well cost was above $4 million (Gilje and Taillard (2015)), and the average cost for a proposed onshore US gas pipeline

[7] The petitioners included the Independent Petroleum Association of America (IPAA), the Western Energy Alliance ("Alliance"), the states of Utah, North Dakota, Wyoming, and Colorado, and the Ute Indian Tribe.

was \$7.65 million per mile in 2015-2016. Second, the oil and gas industry is risky, as the sector is highly cyclical and vulnerable to changes in oil and gas prices. Third, there is ample asymmetric information regarding the investment opportunity set of oil and gas companies, as it is difficult to observe the quality of their reserves. Adverse selection is so pervasive that oil and gas firms make inefficient production decisions to prove the quality of their reserves (Gilje, Loutskina, and Murphy (2020)). The presence of risk and asymmetric information, which deter classical bank lending, and the high demand for capital make the industry attractive to PE firms. Figure 1.B shows that the oil and gas industry has concentrated more than 8% of transactions for deals that involve a transfer of control rights in the United States since 2010, according to Preqin. This is quantitatively significant, as the equivalent number for the health care, insurance, or retail sector is lower. The software industry is the only sector that has a larger number of deals in dollar value than the oil and gas industry.

Most PE firms publicly recognize that the environmental corporate policies of their target companies significantly affect their funds returns, as collected in appendix 5. A common theme of these citations is that reducing pollution and increasing the quality of life for the local population allow PE firms to earn extra risk-adjusted returns.

Another unique feature of the oil and gas sector is the presence of DrillCo contracts, a joint venture between a financial investor and an exploration and production (E&P) company. They do not imply the creation of a new firm, contrary to what the name suggests. There is a large variety of DrillCo contracts, and their features are only limited by the creativity of the contracting parties. In its basic form, an investor provides cash in exchange for a working interest in a group of wells drilled and operated by the E&P company. Most of the time, a DrillCo contract contains three main components. In each tranche,[8] the investor provides a capital commitment. This capital commitment is used to pay the development costs of the well(s) and part of the E&P working interests as a form of a carry ("carried amount"). In exchange for the capital commitment, the investors acquire a working interest in each tranche. This working interest

[8] In this case, a tranche is a group of oil and gas wells.

can be subject to partial reversion once pre-determined IRR hurdles are met. More complexity among DrillCo contracts can then be found. For example, the location of the acreage can be made confidential to avoid direct competition with potential competitors. The DrillCo contract can also contain an alternative plan in case the initial wells are dry. The working interest is defined at the wellbore, but can be depth limited. Another important source of heterogeneity in DrillCo contracts is the timing of the payment, regarding both the moment when the investor transfers the funds and when the operator pays back the investors. The development costs of the well(s) can have a specific limit or, for some deals, a budget can be agreed upon.

DrillCo transactions differ in several ways from a traditional PE acquisition. They imply less control from the investors than when an acquisition is made. Most of the operational decisions are undertaken by the E&P company. As Tim Murray from Benefit Street Partners[9] explained: "We don't micro-manage operational details about how you're fracking the wells." Another difference is that there is no change in capital structure, contrary to a leveraged buyout. Finally, in a DrillCo, all the income made by PE investors comes from the working interest in a tranche of wells, and does not come from the exit value of the deal. Therefore, DrillCo contracts are financed from PE funds but without any transfers of control rights, change in capital structure, or pressure to exit the investment.

2 Data, Validation and Summary Statistics

2.1 Data

2.1.1 Oil and gas datasets

The Ground Water Protection Council and the Interstate Oil and Gas Compact Commission launched FracFocus in April 2011, a repository of chemicals used during the fracking process. This repository was first a voluntary disclosure database to report the chemicals used for each

[9] Nissa Darbonne, "The DrillCo," in Oil and Gas Investor, Money Redefined: Capital Formation, June 2016.

well, but states slowly began to impose mandatory reporting to this database. Figure A.1 reports the year in which each state mandated reporting. By 2013, 75% of 28 oil and gas-producing states had instituted mandatory reporting to FracFocus. In 2015, the latest states (Kentucky and North Carolina) had a mandatory reporting to FracFocus.

This administrative dataset allows us to investigate the input used during the production process with an extremely fine degree of granularity. The data report information at the well level, such as longitude and latitude, the API14 number (the regulatory ID of the well), the dates upon which the well job started and was completed, and the name of the operator. The dataset also contains the total number of chemicals used with their CAS number, which allows us to perfectly identify the presence of a toxic chemical. Operators can report a chemical as confidential, and, in this case, the CAS number will be hidden.

I merge the API14 number with detailed data from the private vendor Enverus, which provides information on production (for the first six months of oil and gas extraction), the horizontal length, the vertical depth, and the basin in which the well is drilled. These variables are essential because the first six months of production predict overall future well production with great accuracy. Once the well starts producing, it follows a stable and predictable decline curve.[10] The horizontal and vertical size of the well captures the type of technology used (whether it is a horizontal well) and the cost required during the drilling process (as larger wells are more costly). Moreover, knowing the basin in which the well is located allows us to define an important layer of comparison among wells, as they are more likely to be established within the same infrastructure and rock formation. I drop 30 observations that are not located in the United States onshore because they contain mistakes in the latitude or longitude or because they are offshore projects. I chose to drop offshore projects because they are usually more capital intensive and require specific infrastructures, although all the results remain the same when they are included.

[10]For instance, in the ARPS model, there is a stable linear relationship between the log production of the month and the log of the month.

2.1.2 Data on private equity

My source of PE buyout and PE DrillCo comes from Enverus (DrillingInfo) under the product name "Enverus market intelligence". This dataset offers several advantage over traditional datasets of private equity deals, such as Preqin and Pitchbook. First, Enverus market intelligence records when a deal is a DrillCo. As this contract is unique to the oil and gas industry, it is often not reported in Preqin and Pitchbook.

The second advantage of Enverus market intelligence is that it reports the geographical boundaries (shapefiles) of the assets from the target company. This information is not reported by Preqin or Pitchbook. The project-level data from FracFocus and Enverus do not containt the company address. Therefore, having the shapefiles of the target company allow us to identify precisely the target company assets in a way that is more reliable that a matching process based on the name of the target company.

2.1.3 Data on environmental liability risks

I use three different measures of environmental liability risks. The first measure borrows from the political science literature (Konisky (2007)) and has been applied recently in finance by Seltzer, Starks, and Zhu (2022). I construct a measure of compliance and enforcement regarding the Resource Conservation and Recovery Act (RCRA) using data from EPA's RCRAInfo for hazardous waste sites. The variable enforcement ratio is equal to the number of enforcement actions taken in a state for a given year, divided by the total entities regulated in the state under RCRA. The enforcement actions include notifications of violations, fines, and administrative orders. A state with a high value of enforcement ratio means that a facility there is more likely to be subject to RCRA actions. I standardized and normalized the ratio so that the mean equals zero and the variance is one.

The second measure is the number of votes in a state that do not support a republican candidate in federal elections. Recent research suggests that Democratic states implement more aggressive environmental enforcements and regulation (Bisetti, Lewellen, and Sarkar (2021), Chu et al. (2021), and Gormley, Kaviani, and Maleki (2021)). As a result, states where constituents support the Republican party are more likely to have a lower level of future environmental regulation or enforcement.

The third measure is whether the well is located in a federal or a Native American areas regulated by the Bureau of Land Management (BLM). In particular, between 2015 and 2018, the BLM faced some hurdles in regulating fracking in these areas (see appendix 5 for more institutional details). The source for this variable comes from Fracfocus. It captures the risk of future environmental regulations regarding fracking activities, although it is also likely that this measure identifies different levels of environmental enforcement carried by the BLM.

2.2 Summary statistics

2.2.1 Sample

Table 2 reports the additional basic descriptive statistics of the sample. My sample includes 166,279 US wells fracked between 2012 and 2021 by 1,701 operators. On average, firms use 0.31 toxic components per well—27% of all the wells used at least one toxic component. Only 6.7% of all wells list at least one confidential item. The wells are located in relatively rural areas. More precisely, they are located in zipcode where only 20% of the population lives in urban areas. The wells are also modern: they take on average 8 days to complete and are bi-directional. A sample-average firm has a total of 100 projects scattered among 11 different locations in 1.37 states. The projects are also scattered across 10.25 locations, which are six-by-six square miles.

A total of 6,571 projects are completed by a firm under a PE buyout, and 4,641 projects occur under a PE DrillCo. These deals are made by 56 different investors.

2.2.2 Similarities between federal and Native American regions and others

I exploit the legal events taking place after 2015 regarding the ability of BLM to regulate fracking in Native American and federal territories in the identification strategy. Therefore, it is crucial to investigate whether the projects drilled in Native American reservations and federal lands were similar to the others before the fracking rule was announced in March 2015. One concern would be that contract enforcement[11] or local labor costs would create fundamental differences between the two groups and thus command different usages of toxic pollutants, making causal inferences difficult to obtain.

Table 3 shows the raw differences according to whether a well was drilled in Native American reservations and federal lands before 2015. Most characteristics show no differences between projects located in Native American reservations or federal lands. For instance, the pollution between the two groups before 2015 is almost the same: equal 0.41 for BLM areas and 0.40 for non-BLM areas. Projects in BLM areas are 809.7 feet deeper and 10,2784 MCF (thousand cubic feet) lower than in non-BLM areas.

These are two statistically significant differences, but they are not robust to the inclusion of a location-year fixed effects. The difference in vertical size becomes negligible (equal to 24.29), and the difference in gas production is almost divided by five once the location-year fixed effects are included. This finding is consistent with the idea that location is an important driver in the heterogeneity of projects. Moreover, once the location-year fixed effects are added, most differences in characteristics are reduced by an important magnitude.

2.3 Validation of the dataset

I then present a test that validates the consistency of this new dataset. The test is based on the fact that firms closer to filing for bankruptcy are more likely to pollute. They are riskier and

[11] Brown, Cookson, and Heimer (2017, 2019) exploit the 1953 enactment of PL280 to create plausibly exogenous variations in the enforcement of contracts within Native American reservations, where litigation was enforced in state courts instead of tribal courts for some reservations following the shock. The authors show that this shift affects credit markets, income, financial literacy, and trust. The shocks that are exploited in this study are different.

therefore face a higher cost of capital, which reduces their investment in abatement projects. Moreover, firms close to bankruptcy are more likely to pollute due to a risk-shifting effect: they reap the full benefit of polluting, but part of the expected costs is discharged through bankruptcy. The argument that firms that are more financially constrained or close to bankruptcy are more likely to pollute has received extensive empirical support (Kim and Xu (2017), De Haas and Popov (2019), Levine et al. (2019), Cohn and Deryugina (2018)).

I show in dynamic event windows that the measures of pollution increase just before a chapter 11 bankruptcy filing but then drop. While these correlations do not have a causal interpretation, they are consistent with previously established findings. Specifically, Figure A.2 reports the yearly average of the number of toxic chemicals among firms that file for chapter 11 bankruptcies in an event study around the year of filing, which validates the results found in other settings. Pollution levels increase steadily before filing, peak the year of filing, and then decrease once the probability of default lessens.

3 Empirical Design

I describe the endogeneity problem and the empirical strategy in subsection 3.1; in subsection 3.2, I display how I translate this empirical design into an econometric specification.

3.1 Endogeneity problem and empirical strategy

Two main identification challenges emerge. The first challenge is a selection problem. PE-backed firms could select a portfolio company with a lower expected cost or a higher expected benefit of polluting. The second problem is an omitted variable bias. PE-backed firms lead to many operational changes: they affect capital investment, technology stock, and the labor composition of the portfolio company, all of which impact the overall pollution of the company.

A buyout could cause an indirect and unintended effect on pollution if the capital stock or technology changes following the acquisition.

To handle these challenges, I first include a $\text{Firm}_k \times \text{Year}_t$ fixed effect in all specifications. This fixed effect addresses the selection problem as long as PE-backed firms do not always decide to purchase a company based on a small fraction of their assets. The inclusion of this fixed effect means that any variable that influences the pollution at the firm level can be controlled. It first helps to attenuate the selection problem. Suppose that a company is purchased when a surge in economic activity is taking place. This increase could lead to a spike in the local supply of chemicals, thus making the usage of non-polluting inputs less costly. Therefore, we would observe a decrease in the usage of chemicals after the buyout, which is simply driven by the fact that the chemicals are less expensive now because the buyout took place at a specific moment during the industry development. This fixed effect also helps in addressing the omitted variable bias. A buyout leads to many significant changes at the firm level, which could create an unintended impact on pollution. However, these changes are absorbed by the $\text{Firm}_k \times \text{Year}_t$ fixed effects. For instance, if a firm adopts a new technology following the buyout that leads to an unintended change in pollution for all the subsequent projects, then this effect is absorbed by the $\text{Firm}_k \times \text{Year}_t$ fixed effect.

This fixed effect also helps in addressing the omitted variable bias. A buyout leads to many significant changes at the firm level, which could create an unintended impact on pollution. However, these changes are absorbed by the $\text{Firm}_k \times \text{Year}_t$ fixed effect. For instance, if a firm adopts a new technology following the buyout that leads to an unintended change in pollution for all the subsequent projects, then this effect is absorbed by the $\text{Firm}_k \times \text{Year}_t$ fixed effect.

The second way to handle these challenges is to include a $\text{Location}_j \times \text{Year}_t$ fixed effect. Using geographical variables to control for unobserved differences in technology or productivity between projects is a common approach in studies that uses the fracking industry as an empirical setting (Gilje and Taillard (2015), Gilje, Loutskina, and Murphy (2020)). The main source of value creation in the oil and gas industry comes from constructing an acreage, which is a portfolio of lease contracts that provide the right to drill oil and gas within a specific time range and location. The type of rock and its properties –such as its porosity and permeability, and the distance from existing infrastructure (such as pipelines), which increases the cost of flaring– are similar for two wells that are located in close proximity. Similarly, specific chemical suppliers in the region affect the prices and types of components sold to oil and gas operators. All these variables drive the marginal costs and benefits of polluting and could also affect the acquisition decision of PE firms. By controlling for these variables, I mitigate the influence of omitted forces that could contaminate the empirical analysis.

3.2 Empirical specification

I translate the empirical strategy by estimating the following specification for the chemical i, used by firm k at location j, during the year t:

$$\begin{aligned} Y_{ikjt} = \text{Firm}_k \times \text{Year}_t + \text{Location}_j \times \text{Year}_t + \text{Controls}_{ijt} + \varepsilon_{ijt} \\ + \gamma.(\text{Post Deal}) \times \text{Environmental Liability Risk Measure}_j \end{aligned} \quad (1)$$

The analysis takes place is at the project level. Y_{ikjt} is the measure of pollution, defined at the project level, and Controls_{ijt} includes the first six months of oil and gas production, which are established measures of well production during a well's lifetime.[12] I also include vertical depth and horizontal length as additional controls to capture potential time-varying heterogeneity in the type of technology used.

$\text{Firm}_k \times \text{Year}_t$ is an operator fixed effect interacted with a year fixed effect, which captures any heterogeneity at the firm level that affects the decision to use toxic chemicals. For instance, a PE buyout could lead to a technological upgrade for all projects in the company. This tech-

[12]Oil and gas production rates decline as a function of time, which means that the first 6 months production are a good proxy for the overall production of the well (Arps (1945)).

nological upgrade could have an unintended effect on pollution. Controlling for $\text{Firm}_k \times \text{Year}_t$ allows us to absorb the effect of such comprehensive firm-level operational changes. The other problem, that the $\text{Firm}_k \times \text{Year}_t$ fixed effect attenuates, relates to how companies are selected by PE firms. PE firms could purchase firms based on variables that correlate with the future usage of pollution, such as the production potential of the company. The fixed effect attenuates the impact of this omitted firm-level variable bias by absorbing any time-varying firm-level variation.

Location_j is a geographical fixed effect equal to one for projects that are located in places with the same first two digits of latitude and longitude. Figure A.1 illustrates such groupings by plotting the wells with the same color if they have the same first two digits of latitude and longitude and are situated in one-half of the Marcellus formation. Using geographical variables to control for unobserved differences in technology or productivity between projects is a common approach in the literature that uses the fracking industry as an empirical setting (Gilje and Taillard (2015), Gilje, Loutskina, and Murphy (2020)). I interact this fixed effect with a Year_t to account for how geographical differences could evolve over time.

Several different measures of Environmental Liability Risk Measure_j are used in the paper. The first is whether the project is located in a state with a history of high environmental enforcement. The second is based on the number of votes at time t in a state that did not support a Republican candidate in the most recent election. Finally, the third measure exploits different legal shocks that affected areas regulated by the Bureau of Land Management between 2015 and 2018.

The coefficient of interests is γ: it represents the relative effect of a PE deal on the level of pollution when environmental liability risks are high. Roughly speaking, this coefficient is the outcome of a double difference. I first take the difference in project-level pollution between places with high and low environmental liability for PE-backed firms. Then, this difference is taken among non-PE-backed firms. Finally, the coefficient gamma is the difference between these two differences once any heterogeneity in location or project characteristics is taken into account. The coefficient gamma measures the extent to which PE-backed firms reduce (if the coefficient is negative) or increase (if the coefficient is positive) pollution when environmental liability risks are high compared to non-PE-backed firms.

4 Results and robustness tests

I first provide some state-level stylized facts regarding how PE-backed firms react to environmental liability risks in subsection 4.1. I then exploit a natural experiment to better validate the different sensitivity of firms to environmental liability risks according to their ownership structure in subsection 4.2.

4.1 State-level measures and stylized facts

4.1.1 Baseline

I start the analysis by estimating the baseline specification with state-level measures of environmental liability risks. Specifically, I estimate equation (1) where the variable Environmental Liability Risk Measure$_j$ is equal to a state-level dummy "High enforcement," which takes the value one if the project is located in a state that has a value of "Enforcement ratio" that is above the sample median and zero otherwise.

Columns (2) and (4) of Panel A from Table 4 reports the coefficient γ from equation (1), which is the main coefficient of interests. I observe a reduction in both the extensive and intensive margin in pollution among PE-backed firms in locations exposed to more environmental liability risks. Specifically, PE-backed firms reduce the usage of toxic chemicals in their fracking mix by 24.757% when they operate in a state with higher enforcement risks and, on average, use 0.174 fewer toxic chemicals. Given that 27.429% of the projects in the sample use at least one toxic chemicals, the reduction is economically significant, equal to 90% of the baseline usage rate of toxic chemicals. Instead of using the dummy variable "High enforcement," columns

(1) and (3) of Panel A in Table 4 report the coefficients when the continuous measure of the variable "Enforcement ratio" is used as a proxy for the Environmental Liability Risk Measure$_j$. The economic magnitudes remain the same, with stronger effects over the intensive margin.

Panel B in Table 4 replicates the same exercise, but focuses on another type of deal: PE DrillCo, a contract where the company receives equity from a PE investor without any control rights from the PE firm. Overall, there is a substantial absence of an effect across all specifications: the point estimates are statistically non-significant and close to zero. For instance, there is a non-statistically significant reduction of 0.199% when a project is financed by a DrillCo in a state with high enforcement risks. This reduction of 0.199% is equivalent to 0.72% of the baseline usage rate of toxic chemicals and represents only 0.80% of the marginal impact of a PE buyout.

Overall, the results are consistent with the argument that a PE buyout provides high-powered incentives to maxmize the profits of the target company. A PE buyout provides a form of ownership that better aligns the incentives of owners and the corporate managers (Jensen (1989), Gompers, Kaplan, and Mukharlyamov (2016), Morris and Phalippou (2020)). The use of greater debt disciplines managers, and PE firms increase managerial incentives to maximize profit through performance-based pay or better management practices (Bloom, Sadun, and Van Reenen (2015)). On behalf of limited partners, general partners control the board of their portfolio companies and actively monitor them. Moreover, general partners rarely have any personal connections with local communities that could interfere with pollution decisions. It is optimal to reduce pollution when the legal cost associated with pollution emissions is higher, which explains why I observe a stronger response of PE-backed firms to these risks.

Conversely, I do not observe such a reduction in a PE DrillCo, when the PE investors only provide financing to the target company. This finding is consistent with the view that the effect is driven by the ability of the PE firm to control the management team of the target company. The ability to influence managers is possible in a buyout but not in a DrillCo contract, as a buyout confers to the PE firm substantial control rights over the portfolio company.

4.1.2 Robustness tests

I run several robustness tests to evaluate the sensitivity of the results. As PE deals are staggered, and the effects are potentially heterogeneous, the results could be exposed to a bias in a specification when two-way fixed effects are included, as shown by De Chaisemartin and d'Haultfoeuille (2020). Notice that the inclusion of a granular location-year fixed effect mitigates this concern, as it becomes less likely that I systematically compare a project from a PE firm to another project from a firm that will be acquired in the future by a PE investor. To address this concern, I replicate the baseline results within a matched sample.

The matching sample is constructed in the following way. For each project that is located in a state with high enforcement risks and owned by a firm that is (or will be) PE-backed, I match the project located in the same hyper-local area and completed during the same year that has the closest size (vertical and horizontal length) and production (using the first six months of production of oil and gas) using the Mahalanobis distance metric. I perform a relatively similar matching approach for the tests that relate to the DrillCo deal. I replace the variable of whether the firm will be (or is) under a PE buyout, with the variable of whether the projects are (or will be) completed by a firm under a DrillCo contract.

I then estimate the specification (1) on this matched sample, but without including the hyper-local area by year fixed effect. Using the nearest neighbor matching approach to construct the sample implies that the sample size is smaller. As a result, I cannot include the hyper-local area by year fixed effect of equation (1) in this sample without dropping a significant number of observations.

Table 5 contains the results of the matched sample. Panel A reports the results for PE buyouts while Panel B focuses on DrillCo contracts. Overall, the results for PE buyouts are both statistically and economically stronger, while the results for PE DrillCo are still economically low and statistically non-significant. For instance, firms that are PE-backed reduce by 33% the number of toxic chemicals they use during the fracturing process if the project is located in a high enforcement state. The magnitude is only equal to 17.4% in the full sample. Conversely, firms under a PE DrillCo contract do not react to an enforcement risk by reducing the usage of toxic chemicals. For instance, they only reduce by 3.8% the number of toxic chemicals used during production if the project is located in a high enforcement state. The effect is not statistically significant and represents only 10% of the baseline usage of toxic chemicals by firms.

Next, I exploit another measure of environmental liability risk to investigate the robustness of the findings. I rely on whether the constituent in the state vote more for the Democratic party. Recent research suggests that Democratic states implement higher environmental enforcement and regulations (Bisetti, Lewellen, and Sarkar (2021), Chu et al. (2021), and Gormley, Kaviani, and Maleki (2021)). Table 6 illustrates the results. Overall, the results are consistent with the previous findings. Specifically, I observe a strong reduction in pollution releases, both on the extensive and intensive margins, when PE-backed firms drill in locations that are more exposed to environmental liability risks.

Finally, I run several specification curves to transparently show how one control affects the point estimates. I follow an approach similar to Simonsohn, Simmons, and Nelson (2019), Cookson (2018), and Akey, Heimer, and Lewellen (2021). The specification curves are depicted in Figures 4 and 5, for both the extensive and intensive margins, using both proxies for environmental liability risks. When the measure of environmental risk is based on the enforcement risk measure, I observe a range of point estimates from -24.81 to-11.05 for the intensive margin, and from -0.17 to -0.1 for the extensive margin. When the measure of environmental risk is constructed using the state-level political support for the Democratic party, I observe a range of point estimates from -0.54 to -0.51 for the extensive margin, and from -53.72 to -52.09 for the intensive margin.

Several remarks are worth noting from the specification curve exercise. First, project-level characteristics, such as the technology used (measured by the vertical and horizontal size of the project) or the production of the well (proxied by the first six months of oil and gas production), do not change the point estimates in an economically meaningful way. This result is consistent with the view that the fixed-effect approach of this paper captures a critical component of project-level heterogeneity between PE-backed firms and non-PE-backed firms. For instance, the hyper-local area fixed effect captures differences in project-level productivity between non-PE-backed firms and those that are not. This result is consistent with the findings of Gilje, Loutskina, and Murphy (2020), who find that geographical variables attenuate the difference in productivity between firms with high-leverage and low leverage.

Second, I under-estimate the effect when I do not include the controls responsible for large variations in the point estimates. When I do not include the state-year fixed effect,[13] then the coefficients are closer to zero. For instance, in Panels A and B of Figure 4, the coefficients are on average equal to -11.25 when the state-year fixed effect is not included, and then is equal to -24.81 on average once they are included.

Finally, the specification curves show that the results are unlikely to be driven by strategic reporting. Notably, companies can report a chemical as confidential if the component is a trade secret, which is one potential way to avoid reporting a toxic chemical. Companies face limited incentives to misreport, because the usage of toxic chemicals is not forbidden, and as such, there is no cost to report a toxic chemical in itself. However, if the toxic chemical creates a contamination, the firm will be exposed to several types of environmental liabilities. To investigate whether the effect is driven by strategic reporting, I include a fixed effect equal to the number of confidential items the company reports. The idea of this test is to absorb any effect that would be driven by an increase in trade secrets. As seen on the specification curves, the inclusion of such an effect does not alter the coefficients in an economically meaningful way,

[13]In a standard difference-in-differences specification, the post variable is interacted with a group variable, but the post and group variable are directly included in the specification when they are not strictly colinear with the fixed effect. The group variable in our case is whether the project is located in a place with high environmental risks. This group variable is strictly colinear with the state-year fixed effect. When I do not include the state-year fixed effect in the specification curves, I include instead the group variable—-That is, wether the state has a high enforcement rate—- in the specification.

consistent with the idea that the effects are not driven by increased strategic reporting following a PE buyout.

4.2 Natural experiment

Although the previous results are informative, I cannot rule out the possibility of a selection bias between PE ownership and pollution or their exposure to environmental liability risks. To better validate the interpretation that PE-backed firms are more responsive to legal changes regarding the liabilities they faces, I next exploit a natural experiment that plausibly exogenously changes the environmental liability risks for some areas but not others.

4.2.1 Baseline

I consider another measure of environmental liability risk that occurs outside of state legislation and takes place within a state boundary. As shown in the previous section, these areas are federal and Native American lands, which were subject to less environmental liability risks between 2015 and 2018, following a succession of political and legal events. Appendix 5 details the events and their institutional context.

I start by plotting the differences in pollution for each year within PE-backed firms between BLM areas and non-BLM areas. Figure 7 plots the estimated (τ) coefficients of the following estimated equation:

$$Y_{ikjt} = \text{Firm}_i \times \text{Year}_t + \sum_{\tau=2012}^{2019} (\text{year=}\tau) \times (\text{BLM})_i \times \theta_\tau + X_{it} + \varepsilon_{ijt} \quad (2)$$

where $(\text{BLM})_i$is a dummy variable that takes the value one if the project is located on a federal or Native American lands regulated by the BLM and 0 otherwise. The reference year is 2014, which is the year before the shock takes place. As seen in the plot, there is an increase in pollution among areas regulated by the BLM between 2015 and 2017. The increase peaks in 2017, when the Trump administration rescinded the fracking rule. The legal response of the state of California following the rescind implies a non-statistically significant increase in pollution for the years after 2018, supporting the view that this legal response was credible in creating higher future environmental liabilities for operators. Although the point estimate is positive for 2015, there is a wide variance in the point estimate, which is consistent with the view that the 2015 preliminary injunction was not a permanent court decision, and operators were facing a significant amount of uncertainty regarding the outcome of the rule. Moreover, the dynamic plots suggest that the effect was not driven by a pre-trend before 2015.

I then estimate a variant of equation (1), where I use as a variable of $\text{Environmental Liability Risk Measure}_j$ the variable $(\text{BLM})_i \times 2017$ or $(\text{BLM})_i \times \text{Federal court ruling}$. The first variable is an interaction term between the BLM dummy and a dummy variable that takes the value of one if the well was drilled in 2017—the year when the fracking rule was voided by the Trump administration—and zero otherwise. The second variable is also an interaction term between the BLM dummy and the Federal court ruling dummy variable. The variable Federal court ruling equals one if the well has been drilled between 09/30/2015 and 01/24/2018 and zero otherwise. Respectively, these two dates correspond to when the preliminary injunction that challenged the fracking rule was granted by the Federal Court of the 10th Circuit (09/30/2015) and when the state of California and a group of environmental activists sued the BLM for voiding the rule (01/24/2018).

Table 7 contains the results. Overall, I observe an increase, both on the extensive and intensive margins, in pollution when environmental liability risk is low. The effects are stronger in 2017 when the Trump administration voided the rule. The economic magnitudes of the effect are meaningful: PE-backed firms increase by 39.88% the usage of at least one toxic chemical in locations where environmental liability risk is low, compared to places that do not experience a change in environmental liability risk and compared to non-PE-backed firms. Overall, the results of this shock validate the previous state-level findings that PE-backed firms reduce (increase) the release of toxic chemicals when the environmental liability risks attached to this practice are higher (lower).

4.2.2 Robustness tests

I run 256 distinct regressions to construct the specification curves and investigate the robustness of the results. The point estimates are stable when the combination of controls varies. Specifically, the estimates range from 35.44 to 39.78 for the extensive margin and from .348 to .44 for the intensive margin, with an average of 37.63 and 0.39, respectively. Accounting for project-level characteristics does not affect the estimated coefficients in an economically meaningful way.

Not controlling for different state-level trends or the presence of confidential items leads to an underestimation of the effects by a small margin. Specifically, the coefficients are, on average, equal to 0.39 for the intensive margin and 37.14 for the extensive margin when the state-level trends are omitted, with a value of 0.4 and 38.13, respectively, when they are included. When the fixed effects, that control for the number of confidential items reported, are not included in the specification, the point estimates are, on average, equal to .35 for the intensive margin and 36.03 for the extensive margin, for a value equal to 0.43 and 39.24, respectively, when they are included in the specification. Overall, the specification curves suggest that the effect is unlikely to be driven by omitted forces other than the legal and political shocks that affected BLM and non-BLM areas differently between 2015 and 2018.

5 Conclusion

This paper shows that PE-backed firms are more likely to increase (decrease) pollution when they face lower (higher) environmental liability. In particular, PE-backed firms decrease the usage of at least one toxic chemical by 24.8% for a project that is located in a state with high enforcement risk and by 52,2% for projects located in state where a majority of voters support the Democratic party. I confirm these state-level stylized facts by exploiting plausibly exogenous legal and political shocks that reduced the ability of the Bureau of Land management to regulate fracking among native american and federal lands. Using these shocks and comparing projects on each side of the different areas, I found that when environmental liability is low, PE-backed firms increase pollution by 39.87%. These results are consistent with the fact that PE ownership leads to environmental corporate policies that are heterogeneous and depend on the environmental liability risks that their projects are facing. This study is the first to show the role of legal risks in understanding the operational consequences of PE buyouts and how they affect stakeholders' welfare.

This paper highlights that changes in the corporate governance of firms that are under a PE buyout is an important feature of the PE investment model. PE-backed firms have high-powered incentives and means to maximize profit compared to both publicly-listed and closely-held private firms. Compared to a publicly-listed company, the managers of a PE-backed firm are less entrenched (Jensen (1989), Gompers, Kaplan, and Mukharlyamov (2016), Morris and Phalippou (2020)). Managerial entrenchment creates an incentive to maximize short-term value at the expense of long-term value (Stein (1989), Grenadier and Malenko (2011)). One way to increase short-term value is to increase long-term legal costs by increasing current pollution and saving the immediate abatement cost. Moreover, compared to privately-held companies, PE-backed firms face fewer financial constraints (Malenko and Malenko (2015)) that hinder the investments in abatement technology (Kim and Xu (2017)). They also possess more significant legal knowledge, and the general partners have ample industrial experience (Bernstein and Sheen (2016)). As a result, PE-backed firms more substantial incentives than other privately-held companies to reduce pollution when environmental liability risks increase.

There are at least two questions for further work. First, this paper focuses on the materiability of ESG investing, that is when companies change their environmental practices to maximize their profits. However, it would be interesting to investigate whether private equity is an investment class that has superior contractual features for implementing the non-pecuniary preferences of their limited partners, which is another important component of ESG investing. This question is unclear and relevant given the recent surge of impact investing and the existence of impact investing in private markets (Barber, Morse, and Yasuda (2021)). The ability of PE firms to closely monitor their portfolio companies for environmental matters, as shown in this paper, is one way they could provide an advantage to investors interested in implementing more environmentally friendly policies. However, it becomes more difficult for limited partners to monitor PE's firms actions because of their private nature. Second, recent work highlights the importance of environmental liability risks in firms' ability to secure their debt (Bellon (2021) and Choy et al. (2021)) and document an important growth in ESG loans (Kim et al. (2022)) and green bonds (Flammer (2021)). How banks' sensitivity to environmental factors — either for risk or non-pecuniary motivations— affects the operational outcomes of PE leveraged buyouts through their ability to improve the pledgeable income of PE's portfolio companies is unknown.

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Tables / Figures

Figure 1: Importance of pollution among PE deals

Figure 1.A

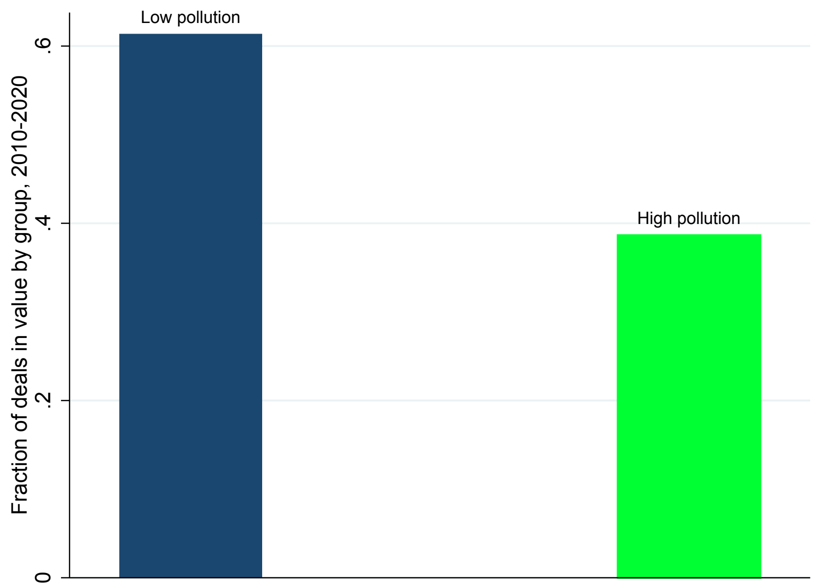
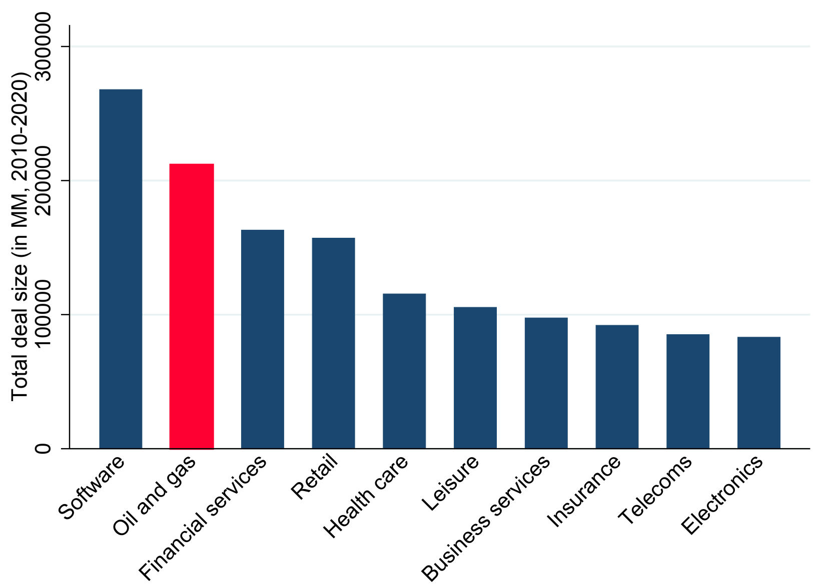


Figure 1.B



Note: Figure 1.A reports the fraction of PE investment in dollar value where a control right is transferred in industries that emit a significant amount of pollution. This includes natural resources, energy, transportation, infrastructure and manufacturing industries. Figure 1.B reports the cumulative amount of the deal size in million of dollars between 2010 and 2020 for the ten industries that have the highest amount of deals in dollar values. For both graphs, the investment types are: Add-on, Buyout, Growth Capital and PIPE. I use deal-level data from Preqin to compute the figures.

Figure 2: Distribution Of Projects

Figure 2.A: all projects

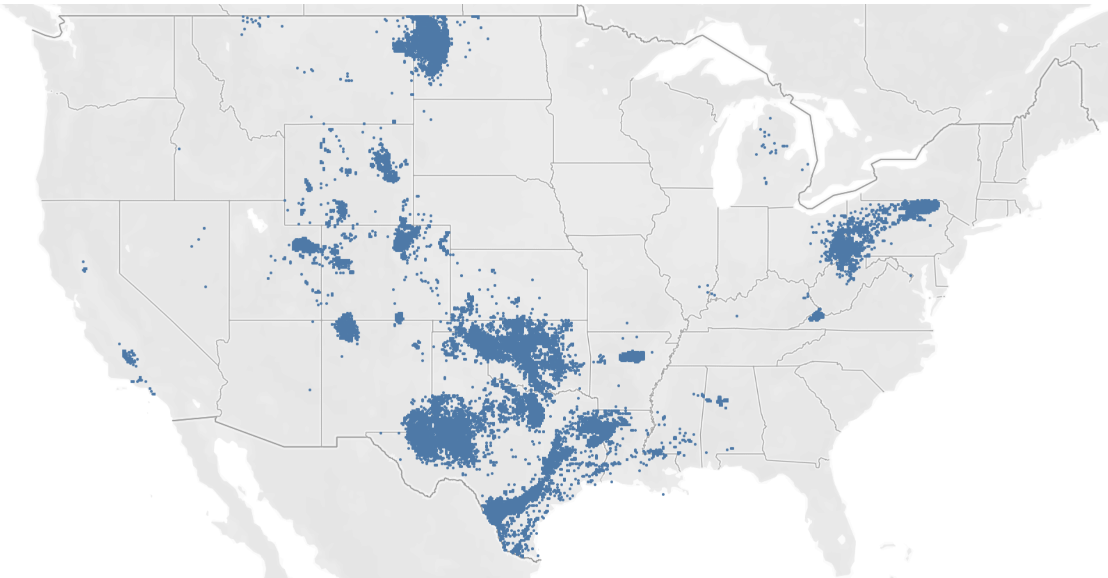
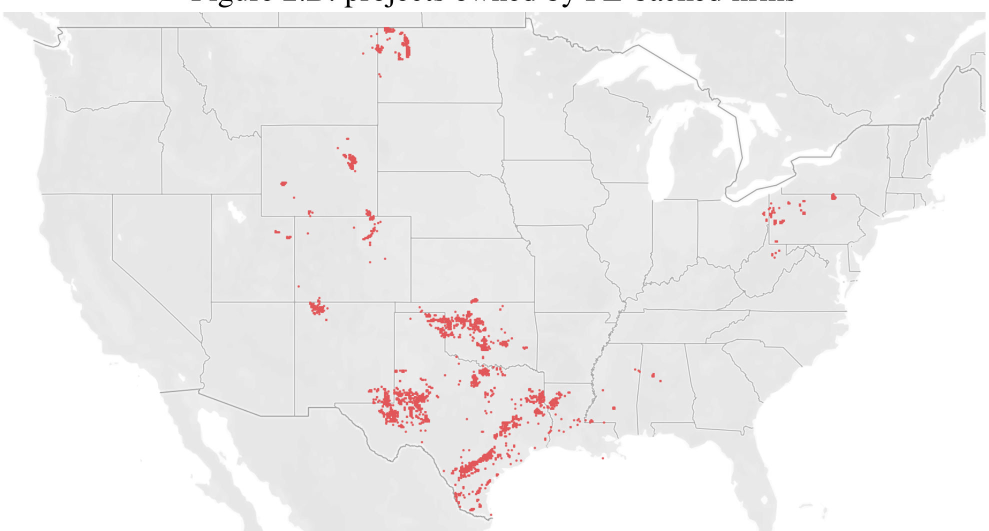
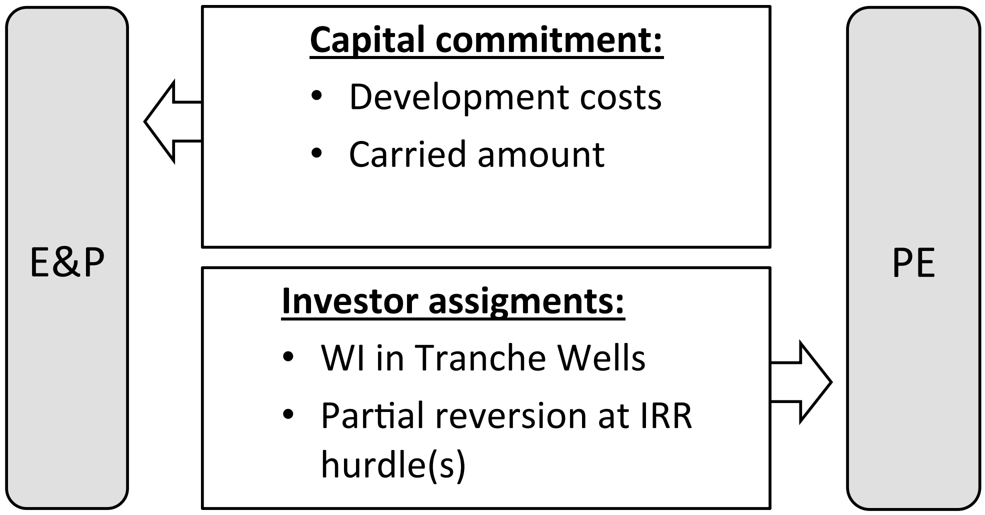


Figure 2.B: projects owned by PE-backed firms



Note: These two figure show the location of the projects that I use in the statistical analysis. Sub-figure (a) shows all the projects, whereas sub-figure (b) only plots the projects that are owned by a PE-backed firm at some point in the sample.

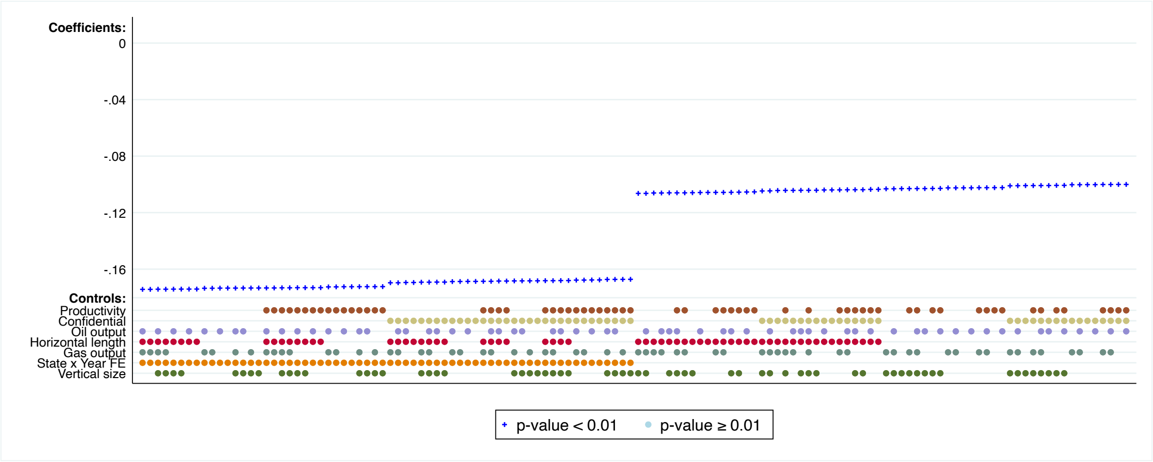
Figure 3: Structure Of A DrillCo Deal



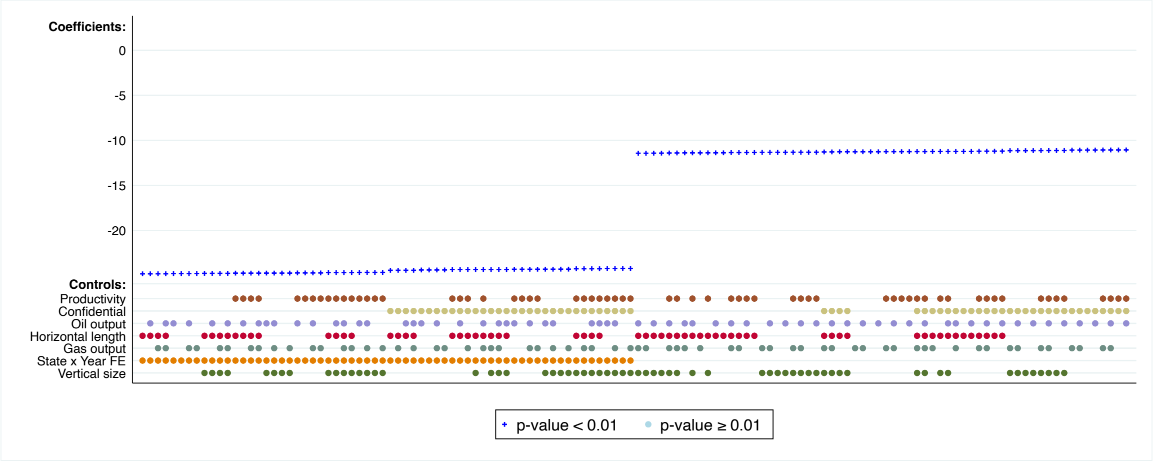
Note: This figure summarizes the structure of a DrillCo deal between a Private Equity (PE) firm and an exploration & production (E&P) company.

Figure 4: Specification curves (1/3)

Panel A: Number of chemicals



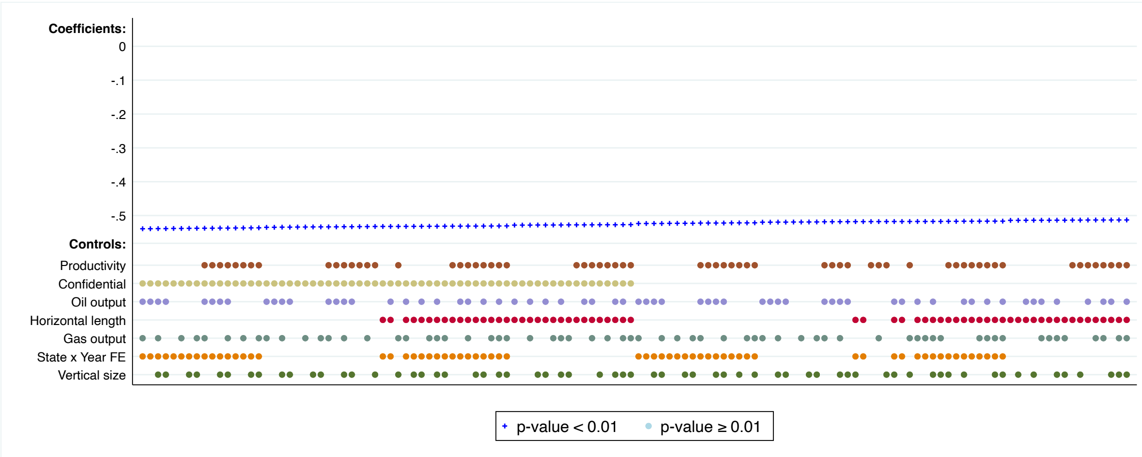
Panel B: Number of chemicals>0



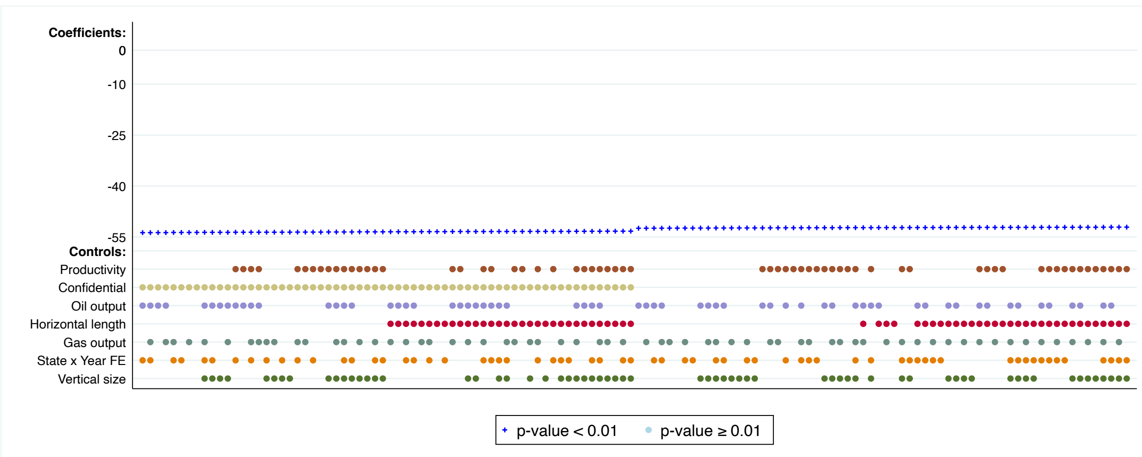
Note: These graphs depict the specification curves of the baseline estimations. The dependent variable is either the Number of chemicals (Panel A) or the a dummy variable that takes the value one if the firm is using at least one toxic chemicals, and 0 otherwise. The graphs report the point estimate of the interaction coefficient Post buyout$_{it} \times$ High enforcement, when different controls are included. All specifications include a Location FE$_j \times$year FE$_t$ and a Firm FE$_j \times$year FE$_t$ fixed effects.

Figure 5: Specification curves (2/3)

Panel A: Number of chemicals



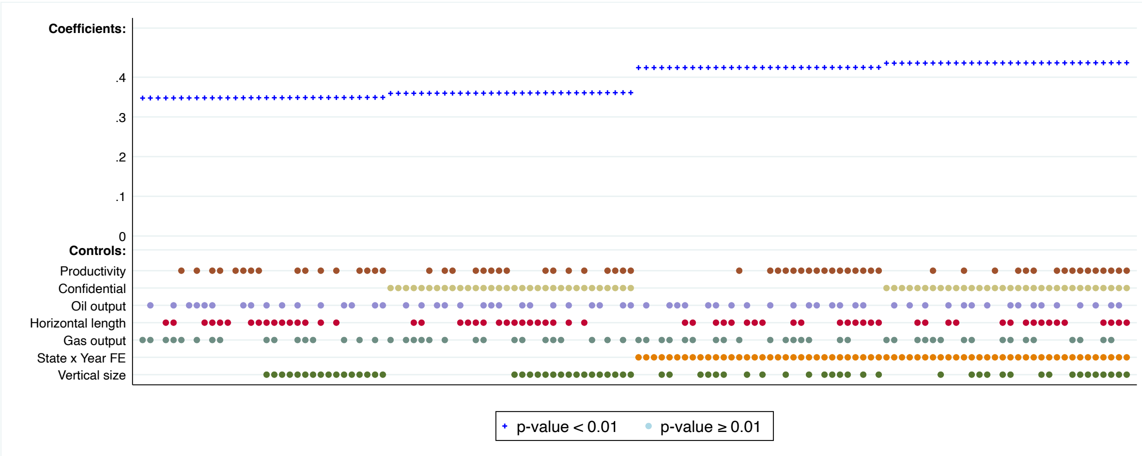
Panel B: Number of chemicals>0



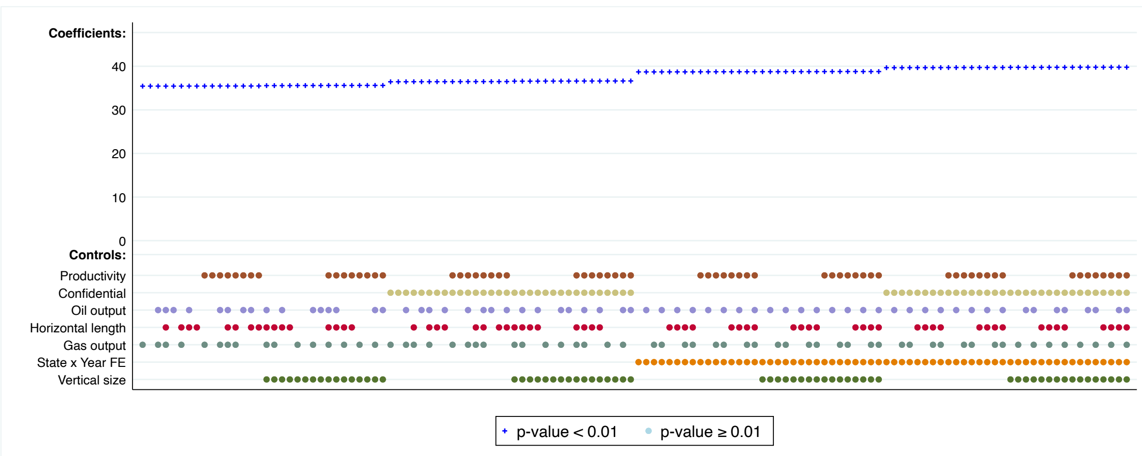
Note: These graphs depict the specification curves of the baseline estimations. The dependent variable is either the Number of chemicals (Panel A) or the a dummy variable that takes the value one if the firm is using at least one toxic chemicals, and 0 otherwise. The graphs report the point estimate of the interaction coefficient Post buyout$_{it}\times$ Democrats, when different controls are included. Democrats is a dummy variable that takes the value one for states that have a majority of votes supporting the Democratic party. All specifications include a Location FE$_j \times$year FE$_t$ and a Firm FE$_j \times$year FE$_t$ fixed effects.

Figure 6: Specification curves (3/3)

Panel A: Number of chemicals

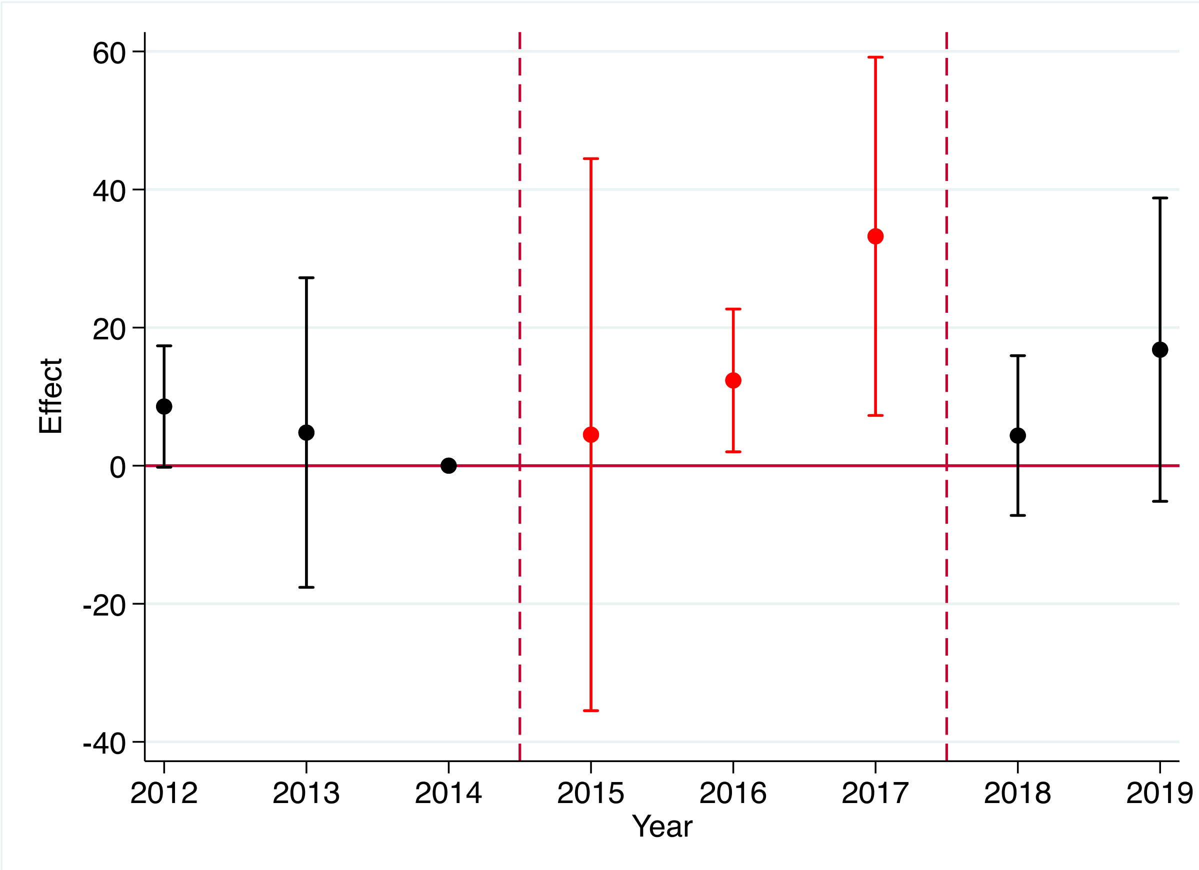


Panel B: Number of chemicals>0



Note: These graphs depict the specification curves of the the natural experiment, when the ability of the bureau of land management to regulate fracking was reduced. The dependent variable is either the Number of chemicals (Panel A) or the a dummy variable that takes the value one if the firm is using at least one toxic chemicals, and 0 otherwise (Panel B). The graphs report the point estimate of the interaction coefficient Post buyout$_{it}\times$ BLM $\times$2007, when different controls are included. All specifications include a Location FE$_j\times$year FE$_t$ and a Firm FE$_j\times$year FE$_t$ fixed effects.

Figure 7: Impact Of Decreased Litigation Risks



Note: This figure shows the dynamic difference-in-differences estimates on how PE-backed firms reacted to changes in BLM authority to regulate fracking in Federal lands and Native American reservations. It plots the $(\theta_\tau)_{\tau=2013,\ldots,2019}$ from the following estimated equation:

$$Y_{ijt} = \text{Firm}_i \times \text{Year}_t + \sum_{\tau=2013}^{2019} (\text{year}=\tau) \times (\text{BLM})_i \times \theta_\tau + X_{it} + \varepsilon_{ijt} \tag{2}$$

Y_{ijt} is a dummy variable that takes the value one if at least one toxic chemical is used and zero otherwise. The definition of toxic chemicals follow table 1. BLM_i is a dummy that takes one if the well is located in a Federal land or a Native American reservation, 0 otherwise. Firm_i is an operator fixed effect, that captures any heterogeneity at the firm level that is constant through time and affects the decision to use toxic chemical. Standard errors are clustered at the firm level and confidence intervals at the 10% level are reported. 2015 to 2017 include the time when the preliminary injunction was granted, the rule stroke down by the district of Wyoming and when the rule was voided by BLM (July 25, 2017) following the Trump administration policy. Finally, the period between 2018 and 2019 correspond to the time during which the State of California Jan. 24, 2018 sued BLM for his decision to rescind the rule.

Table 1: Definition and Source Of Toxic Chemicals

Chemical name	CAS number	Toxicity
2-butoxyethanol	111-76-2	cause hemolysis (destruction of red blood cells), spleen, liver, and bone marrow.
Xylene	1330-20-7	human carcinogen, SDWA, CAA
Toluene	108-88-3	human carcinogen, SDWA, CAA
Ethylbenzene	100-41-4	human carcinogen, SDWA, CAA
Benzene	71-43-2	human carcinogen, SDWA, CAA
Bis(2-ethylhexyl) phthalate	117-81-7	human carcinogen, SDWA, CAA
2-Propenamide	79-06-1	human carcinogen, SDWA, CAA
Copper	7440-50-8	human carcinogen, SDWA, CAA
Lead	7439-92-1	human carcinogen, SDWA, CAA

Note: The Table reports the chemicals used as our main dependent variable. They have in common that they are both highly toxic and salient as they have been reported in environmental reports as well as reports from the United States House of Representatives Committee on Energy and Commerce (for instance, April 2011). Most of them are regulated at the federal level, but the hydraulic fracturing benefits from several exemptions: this industry is not subject to the Safe Drinking Water Act (SDWA) and to several permitting and pollution control requirements from the Clean Air Act (CAA). Human carcinogens are substances that promote the formation of cancers.

Table 2: Descriptive Statistics

Panel A: Descriptive statistics, full sample (project level)

Variable	Obs	Mean	Std	Min	Max
Number of toxic chemicals_*it*	166,279	.3193849	.5638457	0	5
(Number of toxic chemicals_*it* $>$ 0)	166,279	27.4286	44.61551	0	100
Enforcement ratio	162,679	.0100487	.0053779	.0002939	.0356627
PE DrillCo	166,279	.1127142	.316244	0	1
PE Buyout	166,279	.0495913	.2170998	0	1
Fraction urban population	164,380	20.89484	35.06595	0	100
BLM areas	166,279	.064067	.244873	0	1
Productivity	166,279	8.321851	25.69992	0	2977
Vertical size	166,279	8341.202	3220.889	0	39353.2
Horizontal size	166,279	5014.021	4133.054	0	19982.37
Production gas	166,279	242646.3	536542.1	0	9321703
Production oil	166,279	34196.97	47745.78	0	806586
Number of confidential items	166,279	.067507	.2509467	0	2
Number of confidential items>0	166,279	.067495	.2508781	0	1

Panel B: Descriptive statistics, full sample (Firm level)

Variable	Obs	Mean	Std	Min	Max
Projects	1,701	97.75367	457.5058	1	7012
States	1,701	1.512052	1.255342	1	16
Locations	1,701	10.25279	32.22512	1	506

Note: These tables report the baseline descriptive statistics. Panel A reports information for the full sample at the project level and Panel B when data at the firm level are used.

Table 3: Balance Tests

Panel A: Descriptive statistics, full sample (project level)

Variables	BLM areas	Non-BLM areas	Diff.	S.D.	Adj-diff	Adj-S.D.
Number of toxic chemicals_*it*	0.41	0.40	0.0130	0.0395	0.0708	0.0440
(Number of toxic chemicals_*it* > 0)	37.58	34.46	3.120	3.505	5.276	3.459
PE Buyout	0.09	0.07	0.0254	0.0360	0.00569	0.0106
PE DrillCo	0.09	0.11	-0.0189	0.0250	0.00352	0.00675
Urban density	16.05	21.07	-5.024	3.527	0.356	0.378
Urban area	0.2	0.29	-0.0869	0.0448	0.00541	0.00547
productivity	11.12	12.02	-0.906	0.786	0.915*	0.373
Vertical Depth	9286.04	8476.31	809.7**	259.1	-24.29	92.05
Horizontal Length	6187.75	6376.84	-189.1	528.3	237.7*	103.5
First 6 Gas	221877.9	324662.34	-102784.4*	41349.2	-21713.6	13449.2
First 6 Oil	55913.81	45515.07	10398.7	6331.9	1768.1	1979.4
Confidential>0	0.05	0.04	0.0107	0.0185	-0.00391	0.00539
Nb of confidential items	0.05	0.04	0.0107	0.0185	-0.00391	0.00539

Note: These tables report the baseline descriptive statistics of the sample variable used in the analysis.

Table 4: Baseline Results

Panel A: PE Buyout

	Number of toxic chemicals$_{it}$		Number of toxic chemicals$_{it} > 0$	
	(1)	(2)	(3)	(4)
Post buyout$_{it}$ × High enforcement	-0.174** (0.071)		-24.757*** (6.734)	
Post buyout$_{it}$ × Enforcement ratio (std)		-0.069 (0.048)		-12.995*** (4.642)
Observations	156,631	155,595	156,631	155,595
R-squared	0.66	0.66	0.66	0.66
Firm FE$_i$× year FE$_t$	x	x	x	x
State FE$_i$× year FE$_t$	x	x	x	x
Location$_j$× year FE$_t$	x	x	x	x
Project-level controls$_{it}$	x	x	x	x
Mean Dep. Var.	0.319	0.319	27.429	27.429

Panel B: PE DrillCo

	Number of toxic chemicals$_{it}$		Number of toxic chemicals$_{it} > 0$	
	(1)	(2)	(3)	(4)
Post DrillCo$_{it}$ × High enforcement	-0.013 (0.041)		-0.199 (3.304)	
Post DrillCo$_{it}$ × Enforcement ratio (std)		-0.003 (0.043)		-0.100 (3.715)
Observations	156,631	155,595	156,631	155,595
R-squared	0.66	0.66	0.66	0.66
Firm FE$_i$× year FE$_t$	x	x	x	x
State FE$_i$× year FE$_t$	x	x	x	x
Location$_j$× year FE$_t$	x	x	x	x
Project-level controls$_{it}$	x	x	x	x
Mean Dep. Var.	0.319	0.319	27.429	27.429

Note: Columns (1), (2), (3), and (4) report the impact of PE ownership on pollution as a function of environmental risks. The dependent variable of columns (1) and (2) is the number of toxic chemicals used per well. The dependent variable of columns (3) and (4) is a dummy that takes the value one is the well is using at least one toxic chemical and zero otherwise. Panel A reports the estimates for PE buyouts, which imply a change in the target ownership, whereas panel B reports the estimates for PE DrillCo, which do not involve a change in the ownership of the target company. The controls include the size (horizontal length and vertical depth) and production (6 first months production of oil and gas) of the well.

Table 5: Matched Sample

Panel A: PE Buyout

	Number of toxic chemicals$_{it}$		Number of toxic chemicals$_{it} > 0$	
	(1)	(2)	(3)	(4)
Post buyout$_{it}$ × High enforcement	-0.331** (0.168)		-40.775*** (14.574)	
Post buyout$_{it}$ × Enforcement ratio (std)		-0.124* (0.068)		-16.642*** (5.744)
Observations	10,056	9,730	10,056	9,730
R-squared	0.62	0.62	0.66	0.66
Firm FE$_i$× year FE$_t$	x	x	x	x
State FE$_i$× year FE$_t$	x	x	x	x
Project-level controls$_{it}$	x	x	x	x
Mean Dep. Var.	0.419	0.419	34.959	34.959

Panel B: PE DrillCo

	Number of toxic chemicals$_{it}$		Number of toxic chemicals$_{it} > 0$	
	(1)	(2)	(3)	(4)
Post DrillCo$_{it}$ × High enforcement	-0.038 (0.060)		-0.192 (5.195)	
Post DrillCo$_{it}$ × Enforcement ratio (std)		0.032 (0.053)		-0.141 (4.589)
Observations	13,207	13,207	13,207	13,207
R-squared	0.57	0.57	0.50	0.50
Firm FE$_i$× year FE$_t$	x	x	x	x
State FE$_i$× year FE$_t$	x	x	x	x
Project-level controls$_{it}$	x	x	x	x
Mean Dep. Var.	0.377	0.377	30.838	30.838

Note: Columns (1), (2), (3), and (4) report the impact of PE ownership on pollution as a function of environmental risks. The dependent variable of columns (1) and (2) is the number of toxic chemicals used per well. The dependent variable of columns (3) and (4) is a dummy that takes the value one is the well is using at least one toxic chemical and zero otherwise. Panel A reports the estimates for PE buyouts, which imply a change in the target ownership, whereas panel B reports the estimates for PE DrillCo, which are deals that not involve a change in the ownership of the target company. The controls include the size (horizontal length and vertical depth) and production (6 first months production of oil and gas) of the well. The matched sample is constructed as follow: for each project that belongs to a firm that is acquired by a PE and located in a place with an enforcement ratio above the sample median, I matched within the same geographical area and year, the project that has the closest size (horizontal length and vertical depth) and production (6 first months production of oil and gas).

Table 6: Other Proxies for Risks

Panel A: PE Buyout

	Number of toxic chemicals$_{it}$		Number of toxic chemicals$_{it} > 0$	
	(1)	(2)	(3)	(4)
Post buyout$_{it}$ $\times$ Democrats	-0.517***		-52.172***	
	(0.193)		(19.999)	
Post buyout$_{it}$ $\times$ Fraction votes		-1.595**		-210.962***
		(0.637)		(61.874)
Observations	156,631	156,631	156,631	156,631
R-squared	0.66	0.66	0.66	0.66
Firm FE$_i \times$ year FE$_t$	x	x	x	x
State FE$_i \times$ year FE$_t$	x	x	x	x
Location$_j \times$ year FE$_t$	x	x	x	x
Project-level controls$_{it}$	x	x	x	x
Mean Dep. Var.	0.319	0.319	27.429	27.429

Panel B: PE DrillCo

	Number of toxic chemicals$_{it}$		Number of toxic chemicals$_{it} > 0$	
	(1)	(2)	(3)	(4)
Post DrillCo$_{it}$ $\times$ Democrats	-0.026		-2.525	
	(0.059)		(5.385)	
Post DrillCo$_{it}$ $\times$ Fraction votes		-0.069		-4.218
		(0.072)		(6.398)
Observations	156,631	156,631	156,631	156,631
R-squared	0.66	0.66	0.66	0.66
Firm FE$_i \times$ year FE$_t$	x	x	x	x
State FE$_i \times$ year FE$_t$	x	x	x	x
Location$_j \times$ year FE$_t$	x	x	x	x
Project-level controls$_{it}$	x	x	x	x
Mean Dep. Var.	0.319	0.319	27.429	27.429

Note: Columns (1), (2), (3), and (4) report the impact of PE ownership on pollution as a function of environmental risks. In these tables, Two other risk proxies for environmental risks are used. First, I use the variable Democrats, which is a state-level variable that takes the value one if a majority of voters supported a democrat candidate in the last election of the sample year, and zero otherwise . Second, I use the number of Democratic votes divided by the total number of votes. The dependent variable of columns (1) and (2) is the number of toxic chemicals used per well. The dependent variable of columns (3) and (4) is a dummy that takes the value one is the well is using at least one toxic chemical and zero otherwise. Panel A reports the estimates for PE buyouts, which imply a change in the target ownership, whereas panel B reports the estimates for PE DrillCo, which do not involve a change in the ownership of the target company. The controls include the size (horizontal length and vertical depth) and production (6 first months production of oil and gas) of the well.

Table 7: Natural Experiment

	Number of toxic chemicals$_{it}$		Number of toxic chemicals$_{it} > 0$	
	(1)	(2)	(3)	(4)
BLM × Post buyout$_{it}$ × 2007	0.365*		39.877***	
	(0.187)		(12.748)	
BLM × Post buyout$_{it}$ × Post Injunction		0.171		21.250**
		(0.121)		(9.345)
Observations	159,074	159,074	156,631	159,074
R-squared	0.66	0.66	0.66	0.66
Firm FE$_i$× year FE$_t$	x	x	x	x
State FE$_i$× year FE$_t$	x	x	x	x
Location$_j$× year FE$_t$	x	x	x	x
Project-level controls$_{it}$	x	x	x	x
Mean Dep. Var.	0.319	0.319	27.429	27.429

Note: The table reports a triple difference-in-differences that estimate the differential impact of the BLM litigation on pollution for Native American reservations and federal lands for firms that are owned by a PE firm. The variable "Post Injunction" takes the value one if the project starts between 30/09/2015 (day of the preliminary injunction) and 24/01/2018 (day when the State of California sued the BLM over the rescission). The variable 2017 is a dummy that takes the value one for the year 2017, when the fracking rule was abrogated by the Trump administration, and 0 otherwise. The two coefficients of particular interest are: BLM × Post Buyout × Post Injunction and BLM × Post Buyout × 2017. They are both negative, which shows that PE-backed firm increases pollution following a reduction in litigation and compliance risks.

ONLINE APPENDIX

Quote And Citations From The Main PE Sponsors In The Oil And Gas Industry

"Well-managed sustainability strategies not only reduce pressure on our resources, they also yield operational cost savings, healthier and more productive work environments, and more valuable assets." "Saving water helps to preserve our environment as it is limited resource on earth and it will help to ensure a sustainable adequate water supply in future". **TPG Capital**.

"Protecting the environment of the communities in which we operate is critically important." **GSO Capital Partners**.

"We firmly believe that ESG issues can affect the risk-adjusted performance of our investment portfolios to varying degrees across asset classes over time". **GCP Capital Partners**.

"Contributed to national environmental standards formulation process through collaboration with the US Department of Energy to improve shale gas production best practices, disclosure and technology". **First Reserve Corporation**.

"We encourage and embrace the efficient use of natural resources and continuously look for and expect the best environmental solutions for our portfolio companies' operations. We believe that economic considerations in isolation do not provide sufficient guidance for environmentally conscious decision-making that balances the interests of individuals, communities and future generations. We seek to fully comply and/or exceed compliance with applicable environmental regulatory requirements." **EnCap Investments**.

"We recognize the importance of climate change, biodiversity, and human rights, and believe negative impacts on project-affected ecosystems, communities, and the climate should be avoided". **Denham Capital Management**.

"Seek to grow and improve the companies in which they invest for long-term sustainability and to benefit multiple stakeholders, including on environmental, social and governance issues". **Carlyle Group.**

"Protecting the environment of the communities in which we operate is critically important". **Blackstone Group**.

Fracking Rule: Additional Background

The Bureau of Land Management (BLM) is responsible for the environmental regulation of federal land and Native American reservations. As a federal agency within the US Department of the Interior, it oversees one-eighth of the land in the continental United States. Its core mission is "to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations." Within its mission, the BLM supervises the leasing of oil and gas reserves and provides technical advice for drilling operations on Native American reservations.

In 2012, the BLM started drafting a regulation to reduce the negative externalities caused by hydraulic fracturing. After collecting feedback, remarks, and comments, the rule was finalized and made available on March 26, 2015. The regulation was supposed to be effective on June 24, 2015. It comprised several points: (1) improve the disclosure of operational activities, (2) increase the quality and integrity of the wellbore, and (3) increase the standard of water protection. This rule did not forbid the usage of highly toxic chemicals but increased their indirect costs. Specifically, operators were required to "isolate all usable water and other mineral-bearing formations and protect them from contamination." The rule expanded the definition of usable water to include "waters containing up to 10,000 parts per million (ppm) of total dissolved solids," which doubled the previous threshold.

On March 20, 2015, various petitioners filed a motion for a preliminary injunction to challenge the fracking rule[a]. The preliminary injunction was granted by the Federal Court of the 10th Circuit. The court found that "BLM did not have the authority to regulate fracking" (Williams (2015)), ending uncertainty over whether the BLM had legislative power over fracking activities. Specifically, each of the acts used by the BLM to justify its right to enact the Fracking rule, such as the Federal Land Policy and Management Act ("FLPMA") and the Mineral Leasing Act ("MLA") , was rejected by the court, under the reasoning that "none of them gave BLM authority to regulate fracking" (Williams (2015))[b].

On June 21, 2016, the rule was abrogated by the District of Wyoming, and three days later, the BLM appealed. On January 20, 2017, Trump was inaugurated and proceeded to change the political orientation of the BLM, which now no longer supports the fracking rule. An Interior Department Assistant Secretary stated that an "initial review has revealed that the 2015 Rule does not reflect . . . the current Administration's policies and priorities concerning the regulation of hydraulic fracturing on Federal and Indian lands." Shortly after, the Trump administration issued an executive order asking the BLM to rescind the rule.[c] This caused the Tenth Circuit to dismiss the lawsuit as moot on September 21, 2017. The rescind was made official on December 29, 2017.

[a]The petitioners included the Independent Petroleum Association of America (IPAA), the Western Energy Alliance (Alliance), the states of Utah, North Dakota, Wyoming, and Colorado, and the Ute Indian Tribe.

[b]The remaining reasons to grant the preliminary injunction were the following. First, the regulation was not supported by "substantial evidence and lacked rational justification." Second, the consultations with indigenous American tribes were not made in a way consistent with procedures and policies that this regulatory authority should respect. The next two reasons stated that the petitioners would have incurred "irreparable harm" if the regulation was allowed while litigation was pending and these costs outweighed any potential harm to the BLM.

[c]Executive Order No. 13,783, Presidential Executive Order on Promoting Energy Independence and Economic Growth, 82 Fed. Reg. 16,093 (Mar. 28, 2017).

Fracking Rule: Additional Background (2/2)

Following this rescind, the state of California and a group of environmental activists sued the BLM on January 24, 2018, for voiding the fracking rule. Three main reasons were put forward to justify such an action. Firstly, this decision of the BLM was accused of being capricious. The Administrative Procedure Act (henceforth, APA) requires that any agency that decides to change its policy should explain why the new policy is better. . The rescind was supposed to promote energy development on federal and tribal lands by removing regulatory burdens. However, this explanation was not supported by the evidence put forward by the BLM, which found that finds that the price of oil and gas was the main factor affecting the production of fracking activities. Thus, the explanation was deemed to run "runs counter to the evidence before the agency." Secondly, the APA requires that agencies should always act in a way that is allowed by their statute. The rescinding of the fracking rule was seen as contradicting its statute. Indeed, the core missions of the BLM are to prevent "unnecessary or undue degradation" of public lands and to enable the development of energy while ensuring environmental protections. Thirdly, the decision to rescind the rule violated the National Environmental Policy Act as the BLM did not conduct an environmental impact analysis of the repeal.

Figure A.1: High-frequency Geographical Fixed Effect: Geographical Example Using The Marcellus Formation

This map illustrates the coarser geographical fixed effect after zooming on the Marcellus formation.

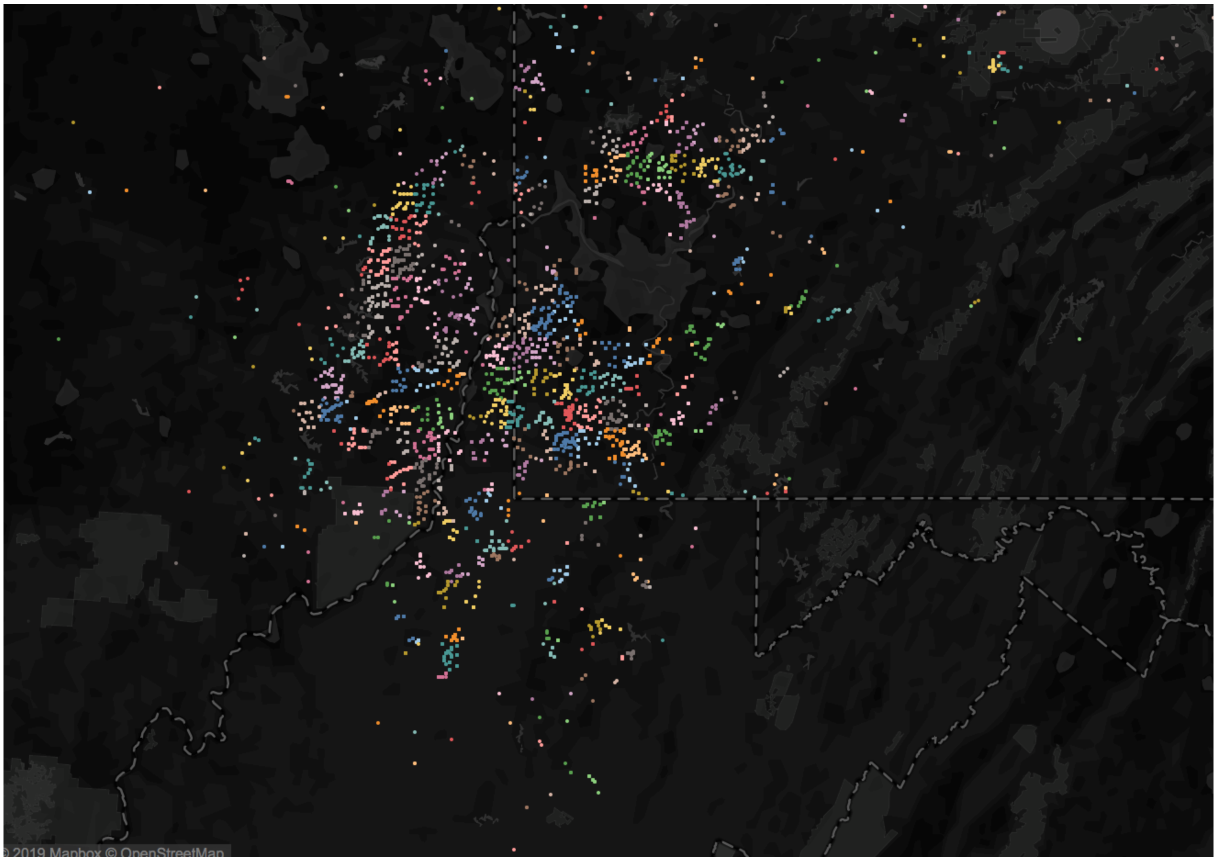
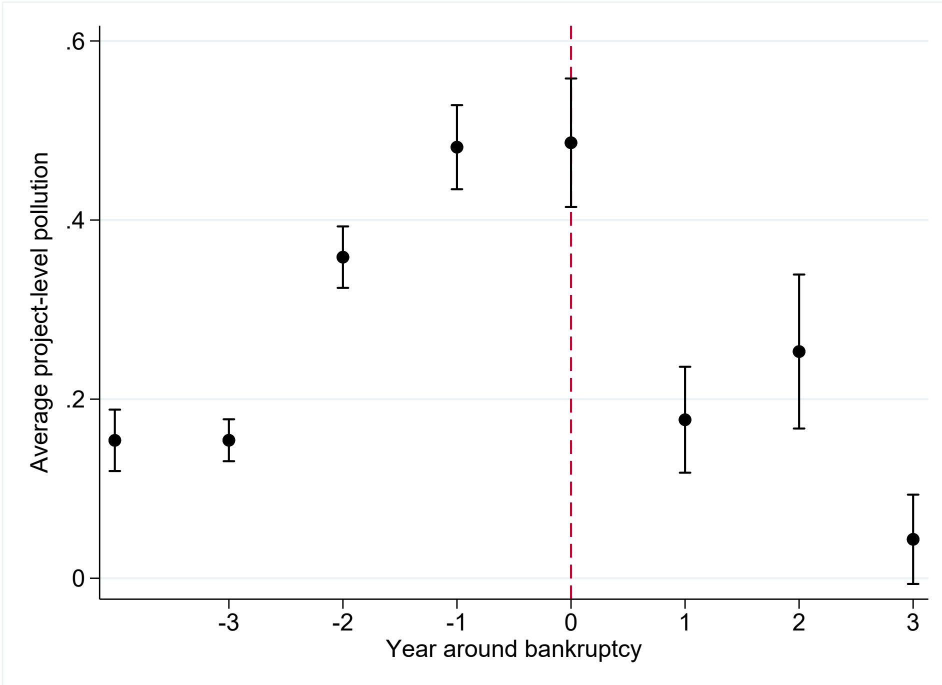


Figure A.2: Pollution for Firms Close to Bankrupty

Panel A



Note: This figure reports the yearly average of the number of toxic chemicals (Panel A) and the fraction of wells flared (panel B) within firms that file for bankruptcy chapter 11 in an event study around the year of filing.

Table A.1: Reporting

2010	2011	2012	2013	2014	2015
Wyoming	Louisiana	Colorado	Alabama	Alaska	Kentucky
	Michigan	Idaho	Arkansas	California	North Carolina
	Montana	Indiana	Kansas	Illinois	
	Texas	New Mexico	Mississippi	Nevada	
		North Dakota	Nebraska	West Virginia	
		Ohio	Tennessee		
		Oklahoma	Utah		
		Pennsylvania			
		South Dakota			

Note: This Table shows the year when reporting to FracFocus became mandatory.

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