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The Broad Impact of a Narrow Conflict: How Natural Resource Windfalls Shape Policy and Politics

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Access to natural resources creates a political conflict between the expected economic winners and their environmental opponents, but the effects of such conflict on policy and politics remain unclear. To examine the scope of such effects, we exploit the rapid and unanticipated technological breakthroughs in the "fracking" of shale gas. During the past decade, shale gas production around the Marcellus Shale formation in the Northeastern United States expanded rapidly. Using a quasi-experimental design, we examine how access to shale gas in electoral districts changed the voting record of House Representatives on environmental policy relative to neighboring districts without access. Votes become 15–20 percentage points less likely to be in favor of the environment. The best explanation for this effect is the strong electoral performance of (anti-environmental) Republicans in shale-affected districts. The narrow conflict has a broad impact: access to natural resources puts downward pressure on environmental policy across the board.

When a new natural resource is found, distributional conflicts between expected winners and losers surface, and the outcome of these conflicts depends on the relative power of various interests (Grossman and Helpman 1994; Olson 1965; Stigler 1971). Because the extraction of natural resources may produce negative externalities, such as water and air pollution, some social groups demand stringent regulations to govern resource extraction. At the same time, political constituencies expecting to benefit from access to the resource demand policies that maximize the pace and minimize the cost of its extraction. These distributional conflicts revolve around the regulation of the extraction of the resource itself.

Although the role of natural resource windfalls in creating distributional conflicts is widely acknowledged, their influence on politics remains unclear. This is because the literature focuses narrowly on the issue that generates the conflict in the first place (e.g., Aldrich 2008; Cheon and Urpelainen 2013; McAdam and Boudet 2012; Rabe 1994, 2014; Stokes 2015). In this article, we provide a theory of how narrow conflicts over natural resources can affect a broader range of regulatory issues through the selection of elected officials with correlated policy preferences. We argue that natural resource windfalls might not only shape how elected officials behave but also, through elections, who they are. In a polarized legislative environment, a narrow conflict over a single regulatory issue might thus produce knock-on effects for unrelated regulatory issues. We provide evidence to discriminate between behavioral and selection mechanisms and show that when natural resource windfalls systematically benefit political parties whose candidates hold anti-environmental preferences, a narrow conflict over a specific natural resource can bring anti-environmental candidates into power, with downward pressure on environmental policy broadly.

We investigate the effects of natural resource windfalls on policy and politics by looking at the case of the American "shale gas revolution" (Deutch 2011). Due to rapid and unexpected advances in extraction technology, the production of natural gas through "fracking" in the United States boomed in the late 2000s. Recent studies show that the local economic

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effects of the fracking boom have been largely positive (Allcott and Keniston 2014; Cust and Poelhekke 2015; Fetzer 2014). At the same time, fracking is a fundamentally political phenomenon. Recent studies identify conflicts over the regulation of fracking, with the industry promoting minimal regulation and local opponents, who often express concern about water pollution, insisting on stringent regulations, or even a blanket ban (Davis 2012; Mallinson 2014; Rabe 2014; Rabe and Borick 2013). Local debates about fracking are often intense. In Susquehanna County, Pennsylvania, reports *The New York Times*, "shale gas development has divided neighbors, spurred lawsuits and sown deep mistrust." At the county seat in Monrose, Florida, a personal-injury law firm advertises with the slogan "HURT by DRILLING?" Meanwhile, in De Soto Parish, Louisiana, fracking is for "some residents … a gift from God."[1]

By examining the political effects of shale gas, we can investigate how access to a resource windfall with potential for environmental destruction shapes voting on policies through the changed incentives of elected officials and preferences of the local population. In particular, if shale gas production has political effects, they should be apparent in environmental and energy policy making. Because the key political cleavages about fracking are related to environmental regulations, such as restrictions on fracking or penalties for groundwater contamination, any political effects of shale gas access should be apparent in roll-call voting behavior related to the narrow set of environmental issues directly related to drilling and fossil fuels. However, we can also examine the broader impact of windfalls by examining how they affect decisions on unrelated environmental issues, such as regulation of oceans, transport, and wildlife. We seek both to identify the political effects of the shale gas boom and to investigate the causal mechanisms that produce these effects. Using records on congressional votes on environmental issues compiled by the League of Conservation Voters (LCV 2013), our analysis focuses on the effects of shale gas on environmental roll-call voting in the House of Representatives.

We identify effects using a regression discontinuity design premised on the ignorability assumptions of local randomization: the assignment of an electoral district to the "shale" or "no-shale" sides of the Marcellus Shale boundary is considered conditionally independent of potential outcomes (Calonico, Cattaneo, and Titiunik 2014; Lee 2008; Skovron and Titiunik 2015). We bolster the identifying assumptions in four ways. First, we employ a difference-in-differences estimator that compares the difference in environmental voting before and after the shale revolution between units with and without shale resource endowments, allowing us to account for any time-invariant differences between units on either side of the border. Specifically, we compare votes in the years 2003–4, unambiguously before the shale gas boom, and in the years 2010–11, after shale gas production had begun. This strategy exploits the rapid and unexpected nature of the shale boom in the areas surrounding the Marcellus Shale. During this period, there was also no electoral redistricting around the Marcellus Shale. Outside Texas, the shale gas boom began so abruptly that we can plausibly rule out any anticipation of the boom by political officials, prior to 2005. Second, we inversely weight our observations by their predicted propensity to fall on either side of the boundary, as a function of district size, addressing concerns about correlation in assignment propensities and outcomes. Third, we only consider direct neighbors along the border in our main specifications, as these are the most likely to have equal propensities of falling on either side of the boundary. Finally, we demonstrate balance on the temporal variation in a host of potentially confounding variables.

Adopting this conservative approach, we find a strong and negative natural resource effect on support for environmental policy in the House. Our analysis of the voting record of House Representatives on environmental policy demonstrates that votes from shale districts become less pro-environment compared to the period prior to the shale revolution, while such change is not observed in votes from districts without shale resources. Relative to the trend over time in the nonshale districts, shale gas reduces the likelihood of favoring the environment in any kind of vote by 15–20 percentage points. The effect is not much larger on voting on issues directly relevant to fracking: the difference is 18 percentage points on votes that are specifically about energy and drilling. The coefficient for issues that are not directly relevant to shale gas remains negative and indicates a 7 percentage point difference-in-difference in the likelihood of adopting a pro-environmental position. These coefficients are not statistically distinguishable from one another, suggesting relative homogeneity in effects across areas of environmental policy.

Why did patterns of voting change? As outcomes are observed at the district level, we distinguish between a change in the behavior of incumbent legislators (behavioral mechanism) and change in the electoral fortunes of pro-environmental and anti-environmental candidates (selection mechanism). The evidence suggests that access to shale gas favored anti-environmental policy primarily due to the electoral gains that Republicans have reaped in districts with access to shale. Analyzing the outcomes of the 2002, 2004 (pre-shale boom), and 2010 (post-shale boom) congressional elections, we find

1. "When a Rig Moves Next Door." *New York Times*, November 6, 2010.

districts with shale resources become about 26–35 percentage points more likely to elect Republicans relative to the time trend in neighboring districts. We only find weak evidence for a behavioral effect.

Thus, the narrow distributional conflict over shale appears to have had a broad impact on policy through elections. Although access to new natural resources such as fossil fuels often calls for new regulations, if an electoral majority stands to gain from extracting those resources, they may put downward pressure on environmental regulation by electing legislators with anti-environmental preferences. One of the core questions in this field concerns the inability of governments to protect the environment and human society from the negative externalities from economic activity (e.g., Hardin 1968; Ostrom 1990). The shale gas boom offers a possible political economy explanation for this policy failure. Because access to resources such as fossil fuels strengthens the political position of anti-environmental forces, a downward spiral in environmental regulation is possible. When natural resources become available, the need for regulations to ensure their sustainable use is the greatest, but political forces drive societies toward deregulation. We argue that political polarization (Layman, Carsey, and Horowitz 2006) broadens the policy effects of shale gas: pro-shale candidates are more likely to win elections and also hold a set of correlated anti-environmental policy preferences that they carry with them into office. This correlation in policy positions held by legislators, a symptom of a politically polarized society (e.g., Converse 1964), implies that narrow conflicts can affect a much broader range of issues if they also impact elections. The combination of electoral selection and partisan polarization at the elite level allows the natural resource windfall to put downward pressure on environmental policy across the board, instead of only generating the domain-specific conflicts found in other studies (Aldrich 2008; McAdam and Boudet 2012; Rabe 1994, 2014; Rabe and Borick 2013).

Our study joins a small but growing body of literature on the political and policy effects of natural resource windfalls beyond the resource curse (e.g., Ross 1999). Stokes (2015) analyzes the divisive politics of wind power in Canadian elections. Adding to a body of literature on retrospective voting, she shows that the local opponents of wind power contributed to an electoral backlash against the incumbent government. Similar to her study, we provide causal estimates for the political impact of a natural resource discovery. However, we examine both the policy and electoral consequences of the winner-loser conflict and focus on a different political issue, shale gas. In our electoral analysis, instead of focusing on incumbency, we emphasize ideological differences between America's two major political parties. We find that the shale gas windfall benefits anti-environmental candidates, while the local losers appear to have little influence over electoral outcomes. The implications of our results are broader than those of a conventional "not in my backyard" electoral backlash: the partisan bias of electoral winners means that the impact is felt across a wider range of policy areas than those directly concerning fossil fuels.

In a working paper, Fedaseyeu, Gilje, and Strahan (2015) investigate the association between shale gas production and Republican electoral success. They compare the electoral fortunes of Democrats and Republicans across American states before and after 2003 (when commercial shale gas production began in Texas) and find Republican challengers gaining at the expense of Democrat incumbents. Their study is the closest to ours in the literature, but our approach differs in two critical respects. First, substantively, we use detailed data on individual votes on environmental policy, as opposed to general summaries at the legislator level. Our primary focus is on how shale gas changes environmental roll-call votes, while Fedaseyeu et al. (2015) restrict their attention to electoral politics. We are not only interested in electoral outcomes but also on whether, why, and how they shape substantive policy formulation in the Congress. In other words, we detail the policy effects of natural resource windfalls in a polarized society. Second, methodologically, their design does not admit any causal claims about the effects of shale gas. Their findings are based on the correlation between shale gas production and the electoral success of Republicans. Since gas production is endogenous to regulatory decisions, it is unsurprising that we should observe such a correlation (Rabe and Borick 2013). We deal with this issue in a local regression discontinuity design that focuses on shale gas deposits, as opposed to production, and weight observations to deal with nonequal probability of having shale deposits. Unlike Fedaseyeu et al. (2015), we also deal with gerrymandering by only focusing on outcomes during the 2003–11 period.

SHALE GAS IN THE UNITED STATES

Because our identification strategy depends on the assumption that shale gas is exogenous to roll-call votes and political outcomes around the Marcellus Shale, we first describe shale gas extraction in the United States. While the industry has been aware of unconventional resources for decades, their widespread exploitation began only toward the year 2010. Thanks to rapid technological advances in hydraulic fracturing, the production of US shale gas has grown exponentially over the past decade. This growth has surprised energy analysts, as it stems from a combination of unforeseen technological advances and unusually high natural gas prices.

While the federal government had supported R&D programs on unconventional natural gas resources during the 1970s energy crises (Wang and Krupnick 2013, 7), commercial extraction only began three decades later.

Areas with shale gas formations underneath them are called basins, and they become plays if the gas can be extracted using current technologies. Therefore, shale plays are areas where the fracking industry can operate on a large scale. In hydraulic fracturing ("fracking"), drilling companies inject a mix of water and chemicals into wells to fracture the shale formation. In combination with advanced extraction technologies, such as horizontal drilling, fracking allows production of gas from reservoirs that were previously too costly to permeate. This technology is key to extracting shale gas from the Marcellus on a commercial basis.

The shale gas boom began amid the declining production of conventional natural gas. As Wang and Krupnick (2013, 2) note, the production of conventional gas had peaked already in the year 1994 and overall production remained approximately stable until the year 2007 only because of the modest expansion of coal bed methane and tight gas production. By 2013, however, 39% of all US natural gas production was from shale.[2] Total natural gas production reached the all time record of 25,700 billion cubic feet, or 30% above the earlier peak in 1994.[3]

The origins of shale gas production are found in the Barnett Shale in Texas. An energy company, Mitchell Energy, developed the technology required for commercial fracking and started development in the Barnett play already in 1982, but technological progress was slow and, before the year 2000, Mitchell never completed more than 70 wells a year. Gradual advances in drilling technology did improve the profitability of fracking, but attempts at horizontal drilling—the critical technology for today's shale gas operations—failed. Only in January 2002 did the independent oil and gas operator Devon Energy buy Mitchell and bring its own expertise, achieving success in horizontal drilling. Until 2007, however, production levels outside Texas remained low.[4] In the year 2007, Texas still produced 76% of all shale gas, while Pennsylvania produced only about 0.01%. In 2013, however, the share of Texas was only 34% and Pennsylvania was producing 27%.

Another key reason for the spread of exploration activity was the rapid increase in natural gas prices, driven by the global economic boom, between the year 2003 and 2008. In 2002, the well-head price had collapsed to USD 3 per million cubic feet, but the same unit price remained above USD 5 for most of the critical 2003–8 period (Wang and Krupnick 2013, 28). However, energy companies only realized the abundance of shale gas in the Marcellus Basin in 2008. Shale gas became heavily publicized when a January 2008 press release on the work of Terry Engelder, a geoscientist at Pennsylvania State University, suggested that studies had dramatically underestimated the Marcellus Shale reserve.[5] The report made energy companies aware of a potentially huge windfall.

SHALE GAS, ENVIRONMENTAL POLICY, AND ELECTORAL POLITICS

We consider the effects of a natural resource windfall on the incentives, behavior, and election of government officials. While the existing literature has not specifically theorized about the winner-loser politics that natural resource windfalls generate, we can develop testable hypotheses by drawing on related bodies of literature. On the one hand, shale gas might create demand for environmental regulations to deal with the negative externalities from fracking. On the other hand, a political economy analysis suggests that shale gas is more likely to put downward pressure on environmental regulations, as the unexpected resource windfall increases the political and economic clout of the energy industry, thus reducing the competitiveness of pro-regulation political candidates. We develop both lines of reasoning into testable hypotheses and then allow our identification strategy to adjudicate their explanatory power.

Both the benefits and costs of shale gas extraction apply to large segments of the population. While some of the rents go to the fossil fuel industry, some also go to landowners who sell access to extractors and to the public through royalties and taxes. Similarly, negative effects such as water pollution and landscape degradation apply to people living in the area in general. Given these considerations, the effects of the shale gas boom should not be conceptualized as a conflict between special interests and the mass public. Instead, shale gas discoveries create conflicts among the population. While most people want both a cleaner environment and more economic growth (e.g., Ansolabehere and Konisky 2014), a shale gas windfall forces them to make difficult choices. The total political effect of the windfall thus depends on the net effect: does the advocacy coalition for stringent regulation grow relatively stronger or do the proponents of low-regulation gain

2. See http://www.eia.gov/tools/faqs/faq.cfm?id=907&t=8 (accessed April 6, 2015).

3. See fig. A1 in the appendix, based on http://www.eia.gov/dnav/ng/hist/n9050us2a.htm (accessed April 6, 2015).

4. See http://www.eia.gov/dnav/ng/ng_prod_shalegas_s1_a.htm (accessed April 6, 2015).

5. See goo.gl/hKPJgK (accessed April 19, 2015).

political power? In what follows, we theorize about the sources of these conflicting demands and link them to electoral politics.

Shale gas and increased demand for environmental policy

Theories of social mobilization against local negative externalities (e.g., Aldrich 2008; Rabe 1994; Stokes 2015) predict that the increased abundance of natural resources creates demand for environmental regulation. Besides concerns about land use and habitat fragmentation, the issue of water pollution has become a central concern. A recent review of fracking and water cautions that "there is a need for comprehensive risk assessment and regulatory oversight for spills and other accidental discharges of wastewater to the environment" (Vidic et al. 2013). While the net effects of shale gas on the local environment are uncertain, such concerns are frequently raised by opponents of shale gas (Mallinson 2014; Rabe 2014; Rabe and Borick 2013). At the same time, many energy analysts also see positive environmental effects of shale gas. Because natural gas tends to displace coal in electricity generation, it allows considerable reductions in carbon dioxide emissions from the power sector (Newell and Raimi 2014) and air pollution (Venkatesh et al. 2012), though these benefits are not localized. On the other hand, some scientists have expressed concern about fugitive emissions of methane, a powerful greenhouse gas, from shale extraction and transmission (Howarth, Santoro, and Ingraffea 2011).

Concerns about the local environmental effects of fracking, such as water pollution and damage to the landscape, increase the salience of environmental issues among pro-environmental voters and political elites. Fracking thus provides politicians with an opportunity to attract the votes of pro-environmental voters. Conversely, elected officials risk losing the support of this coalition, which includes both environmentalists and ordinary citizens concerned about the environmental damage caused by fracking, if they fail to regulate fracking. When concerns about fracking are publicized in the media and disseminated by environmentalists, the public's concern grows, and people demand a response from elected officials. Failure to act prompts some current supporters of the government to either not vote at all or even support the opposition. Indeed, there is some anecdotal evidence for a strong demand among the public for more stringent environmental regulations. In the United States, local campaigns against fracking are by now widespread. Food and Water Watch, an environmental organization campaigning against fracking, reports that, as of August 26, 2015, 487 municipalities in the United States had passed measures to stop fracking.[6] The states of New York and Vermont have also passed bans on fracking.

Shale gas and downward pressure on environmental policy

A political economy analysis suggests that shale gas creates demands for relaxing regulations, as economic interests prevail (e.g., Fedaseyeu et al. 2015; Rabe and Borick 2013). When an exogenous technological shock enables access to shale gas, the local population finds itself sitting on a resource windfall. If fracking is permitted, local values of property on top of shale gas resources surge, and those expecting to benefit thus become a winners' interest group. Municipalities may expect royalties and tax revenue from the economic boom that follows shale gas extraction. Allcott and Keniston (2014) show that American fossil fuel booms have historically had large positive effects on local economic growth and employment. In particular, "oil and gas booms substantially increase local economic growth, although the employment gains are reversed just as quickly during a bust" (Allcott and Keniston 2014, 4). Hardy and Kelsey (2015) examine income tax returns of Pennsylvania residents and find that counties with shale gas production see increases both in employment and royalty returns, with the latter dominating the income effects. While Muehlenbachs, Spiller, and Timmins (2014) find negative effects of shale gas extraction on property values dependent on groundwater, overall they find positive effects already in the short run. Hausman and Kellogg (2015) estimate large positive effects for American consumers of natural gas, and a shift of surplus from conventional gas producers, who suffer from lower wellhead prices, to new producers. Fetzer (2014) reports an 8% increase in personal incomes in counties with at least one unconventional oil or gas well and estimates an overall positive job creation effect of between 500,000 and 600,000. He also finds no evidence for a Dutch disease, as low energy prices benefit local industries.

The support for fracking is amplified by the activities of the industry (Mallinson 2014). Where shale gas is available, the industry has an incentive to support the anti-environmental camp and strengthen the pro-fracking sentiments of the population. If the industry can convince the public that fracking brings large economic benefits at minimal environmental cost, then the industry's ability to purchase land and gain access to the shale resource increases. A side effect of such convincing is that the public will be more favorable toward pro-fracking candidates in elections as well, be they local, state, or federal. In Pennsylvania, for

6. See http://www.foodandwaterwatch.org/water/fracking/anti-fracking-map/ (accessed August 26, 2015).

example, the Marcellus Shale Coalition, an industry group promoting fracking, began a series of television and radio advertisements in September 2014 to convince the local public that fracking is good for the economy and society.[7]

Elections as a causal mechanism: Behavior or selection?

Under democratic political competition, the electoral mechanism is the primary channel through which constituency demand influences the behavior of politicians (Stokes 2015). Elected officials might respond to the availability of fracking when in office by changing their support for pro- or anti-fracking policies, but the windfall may also cause a shift in voting that means different legislators enter office. By examining how the shale gas boom influences electoral outcomes, we can distinguish between a "behavioral" causal mechanism (officials change their voting behavior) and a "selection" causal mechanism (officials with different preferences win elections).

Distinguishing between behavioral and selection causal pathways is essential for grasping the full implications of natural resource windfalls. If the behavioral mechanism dominates, then elected officials adjust their behavior to respond to the demands of the public. In principle this will affect a narrower range of issues. But if the selection mechanism instead drives the results, then the change in partisan competition should, in a polarized society, change policy more broadly.

If there is a selection effect through elections, the direction of the shift depends on the population's preferences. If environmental concerns dominate, then the expected electoral effect should favor pro-environmental candidates. If, all things considered, the public reacts to access to shale gas by increasing demand for environmental protection against the putative negative effects of fracking, then pro-environmental candidates should see their electoral fortunes improve. On the other hand, if economic concerns dominate, then the expected electoral effect should favor anti-environmental candidates.

Using various data sources, Dunlap, Xiao, and McCright (2001) and McCright, Xiao, and Dunlap (2014) show that both Democrat elites and voters have historically been much more favorable to environmental causes than their Republican counterparts, and the difference has grown over time. Using the same LCV data that we use here, McCright et al. (2014, 252) find that, by 2013, the average "environmental voting" score of a Democrat House Representative was close to 90%, while the same score for Republican House Representatives had fallen below 10%. In other words, Democrats vote in favor of the environment in significant roll-call votes nine times out of ten, while Republicans do so fewer than one in ten cases. For all practical purposes, the pro-environmental candidate would be a Democrat.

NATURAL RESOURCES AND ENVIRONMENTAL POLICY: RESEARCH DESIGN

We seek to identify the effect of shale gas resources on environmental votes in the House of Representatives. We examine how the American shale boom changed environmental role call votes by comparing the temporal trend among districts with shale gas resources to the trend among districts without such resources. Formally, our study seeks to identify the following causal estimand:

$$\tau_{\text{shale}} = E[(Y_{\text{shale, post}, j} - Y_{\text{shale, pre}, j}) - (Y_{\text{no-shale, post}, j} - Y_{\text{no-shale, pre}, j}) | X_j \in W],$$

where $Y_{\text{shale, post}, j}$ and $Y_{\text{shale, pre}, j}$ are the jth district's potential outcome following and preceding the shale revolution if it receives a shale endowment, $Y_{\text{no-shale, post}, j}$ and $Y_{\text{no-shale, pre}, j}$ are its potential outcomes following and preceding the shale revolution if it does not receive an endowment, X_j indicates the number of neighboring districts separating district j from the shale border, and $W = [-w, w]$ indicates the window around the border of the shale. For example, a district that is just on the no-shale side of the border is in position -1, and a district just on the shale side of the border is in position 1. Their next neighbors away from the border are in positions -2 and 2, respectively.

Employing a "local randomization" regression discontinuity (RD) design (Calonico et al. 2014; Lee 2008; Skovron and Titiunik 2015), we assume that there is a window on either side of the border of the shale deposit, within which it is as though districts were randomly assigned to either side of the border. In our main analyses we consider units falling into the window specified by $w = 1$, that is, direct neighbors along the border of the shale. As the border of the shale is noncontiguous with district boundaries, we define whether districts are on the "shale" or "no shale" side of the border as a function of how much the play and the district overlap. In our main specifications, we classify districts with 20% or more overlap with the shale as receiving an endowment, and then show that our analyses are robust to respecifications (fig. A9; figs. A1–A10 available in the online appendix). We focus only on electoral districts around the Marcellus Shale, because shale gas extraction began much earlier in the other major shale play, Barnett, Texas, and cannot be considered exogenous for the purposes of identification.

7. See "Shale Gas Industry's Ad Campaign to Promote Fracking," Trib Total Media at http://triblive.com/business/headlines/6853292-74/industry-shale-pavone (accessed August 26, 2015).

The unit of analysis is an individual roll-call vote ("yea," "nay," or absent) in the Congress. The votes are grouped under district-years. In total, our sample has 55 congressional districts in 14 states. Table A5 (tables A1–A21 available in the online appendix) shows the number of treated and control units included in the analysis by state. We assign a district-year to each vote by determining the timing of the vote and electoral district of the House Representative. District-years are then classified as "shale" or "no-shale."

We use the years 2003–4 as a pre-boom baseline for the votes and code votes that took place in the years 2010–11 as post-boom. We start in 2003 because electoral districts around Marcellus remain stable between the years 2003–11. Before the 108th Congress, a major redistricting following the 2000 US census changed the constellation of electoral districts, and we therefore cannot analyze the same units retrospectively into the pre-2003 era. We also exclude the years 2005–9 because we cannot unambiguously attribute these years to the pre- or post-boom period. By 2010, the shale gas boom had already become a real, politically important phenomenon across districts with shale gas deposits. Production was booming, prices were high, and intense exploration activity promised even more production in the future. Thus, by 2010 shale gas was a political reality that elected officials or the media could not avoid (see below for evidence of media attention to shale gas by 2010). By clearly distinguishing between pre-boom and post-boom observations, we guard against temporal measurement error in the explanatory variable. The downside of such a short time period is that environmental problems that appear with delay may have been discounted by the local population and their elected officials. In interpreting our results, this limitation should be kept in mind. We do not, however, use the year 2012 because the results of the extensive redistricting based on the 2010 census were made public well in advance of the 2012 elections. Thus, it is possible that elected officials changed their behavior in 2012 in response to new district boundaries.

With i denoting environmental votes, j districts, k states, and t years, our main specification is

$$\begin{aligned}\text{Pro-Environment}_{ijkt} &= \beta_1 \text{Shale}_{ijk} + \beta_2 \text{Post-boom}_t \\ &+ \beta_3 \text{Shale} \times \text{Post-boom}_{jkt} + \mu_{jk} + \zeta_{jt} + \varepsilon_{ijkt},\end{aligned} \tag{1}$$

where Pro-Environment$_{ijk}$ is a binary variable coded 1 if a legislator from district j was pro-environment in vote i, Shale$_{jk}$ is a binary variable coded 1 if the district j falls on the shale side of the border, Post-boom$_t$ is coded 1 if the year is 2010 or 2011, and Shale × Post-boom$_{ijkt}$ is the interaction of these two variables. The identification strategy focuses on estimating the coefficient β_3. In some specifications, we include district fixed effects μ and state-specific time trends ζ. To account for the clustered nature of the shale assignment and possible interdependencies within electoral units, we cluster standard errors by electoral district throughout. We use linear probability models because alternatives suffer from the incidental parameters problem with fixed effects.

Dependent variable

Our data set indicates whether the Representative voted for or against the environment in the roll-call vote under analysis. Drawing on an annual survey of all significant energy and environmental votes in the House and Senate, the LCV relies on the judgment of an expert panel with 20 members to determine whether "yay" or "nay" is favorable to the environment. We exclude Senate votes because they are held at the state level, resulting in little variation in the explanatory variable. The pro-environmental position is coded as 1 and abstention or anti-environmental positions as 0.

Consider the 2013 scorecard (LCV 2013). In this scorecard, a pro-environment House Representative would vote against an amendment to H.R. 152, the Disaster Relief Appropriations Act of 2013, introduced by John Fleming (R-LA) because the amendment singled out a wildlife refuge as ineligible for federal restoration funding due to damages caused by Hurricane Sandy. A more politically salient example would be Lee Terry's (R-NE) H.R. 3, the Northern Route Approval Act, which "would remove the requirement for a Presidential Permit to build the risky Keystone XL tar sands pipeline, eliminating the Obama Administration's ability to complete adequate safety and environmental impact studies on the project" (LCV 2013, 20). Again, a pro-environment House Representative would vote "no." For a list of example bills, see table A3.

The LCV measure has three major advantages. First, the LCV is careful to consider the significance of the bills included, avoiding the problem of trivial legislation. Second, the LCV uses a standard methodology over the years, allowing us to exploit variation over time. Finally, relying on the LCV's coding means that our own subjective biases cannot influence the construction of the dependent variable. The primary downsides are that we do have to rely on the LCV's perceptions, which could be biased by the organization's strategic imperatives, and challenges of comparing roll-call votes over time, as the legislative agenda of the Congress evolves. As long as these biases and temporal fluctuations are not correlated with shale gas resources, however, these downsides will not compromise our identification strategy and hence generate biased estimates. We also include bill fixed effects in some models as a robustness check (table A9).

Each vote has issue area tags. The LCV attaches nonexclusive tags to each vote, indicating their relevance to broad issue areas, such as clean energy and transportation. As explained below, we use these tags to compare the effect of shale gas discovery on congressional voting on issues that are directly related to fossil fuels to unrelated issues. Unfortunately, we cannot analyze climate change votes because there are no relevant votes during the 2003–4 pre-boom period. See table A4 for the number of environmental votes by issue area and period.

Explanatory variable

Our explanatory variable is the presence of exploitable shale resources—a shale play—in the congressional district. A shale play is commonly defined as "a set of discovered, undiscovered or possible natural gas accumulations that exhibit similar geological characteristics."[8] As we demonstrate in more detail below, the definition of a shale play is ideally suited for an identification strategy based on the exogenous distribution of shale gas with respect to district boundaries, because it does not require the onset of extraction activity or consider possible regulatory issues. Data on the geographical distribution of shale plays comes from shapefiles produced on May 7, 2011, by the US Energy Information Administration.[9]

Congressional districts are assigned to have a shale endowment by falling on the "shale" or "no-shale" side of the border around the shale play. Operating under the assumption that neighboring districts on either side of this border came the closest to falling on the other side of it, we set our bandwidth as narrowly as possible, including only first neighbors on either side of the border (see table A8 for second and third neighbors).

Geographic discontinuity designs frequently exhibit an issue that has been described by Keele and Titiunik (2015) as the "compound treatment problem." It arises when multiple "treatments" simultaneously affect the outcome of interest. In our study, because the unit of assignment is the electoral district, the potential bill-voting and electoral outcomes might be affected both by "irrelevant" district-specific treatments (local electoral dynamics, administrative differences, etc.) and by shale. Note, however, that this is simply a case of clustered assignment, with the 55 electoral districts we consider in our main specifications as clusters. To the extent that our assumptions about ignorability hold true, the compound treatment problem in our case is thus one of uncertainty rather than interpretability or identification.

Some districts have only very small amounts of shale overlapping their borders (fig. A5 shows the histogram of proportion of district areas covered by shale play and basin). To sort districts with 5% or 15% overlap, for example, onto either side of the border, we define a district as being on the shale side of the border when at least one-fifth (20%) of the district has exploitable reserves lying underneath it. In practice, so few districts are resorted by this decision that our estimates are robust to any sorting rule between 10% and 25%.

The Appalachian basin and the surrounding districts are shown in figure 1. The districts colored dark gray (with and without dots) constitute the main sample that is considered in the analysis: these are the units that just received or just did not receive an endowment in shale resources, and thus we assume that they constitute the best comparison in terms of being alike in their potential outcomes.

Since some districts are bigger than others and shale forms a large, singular polygon, bigger units have a lower propensity to fully cover the shale than smaller units. If these differences in probability are correlated with the potential outcomes—say, if larger districts are also more anti-environmental—unweighted estimators will produce biased estimates. We thus use a binary explanatory variable and weight observations by the inverse of their predicted propensity to obtain unbiased estimates (Angrist and Pischke 2009, 84; Gerber and Green 2012, 76, 270–71).[10]

Identifying assumption: Exogeneity of shale gas

An important feature of our assignment mechanism is the exogeneity of district borders to that of the shale play. Gerrymandering is a well-known part of American politics. One concern with our strategy might be that the shape of district borders formed endogenously to concerns about resources in the pre- or post-boom era. By limiting our analysis to congressional districts in the direct vicinity of the Appalachian Basin, and defining the "pre-boom" period as 2003–4, we are able to minimize this concern greatly. There was no substantial redistricting in the districts in our sample between 2003 and 2011.[11] Most importantly, we exclude the Texas shale basins and plays, notably Barnett, as they were already experiencing

8. See http://energy.gov/sites/prod/files/2013/04/f0/shale_gas_glossary.pdf (accessed January 26, 2016).

9. See https://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/maps/maps.htm (accessed December 5, 2014).

10. We predict each unit's propensity to fall either side of the threshold that receives the shale endowment using a probit regression of the endowment on district surface area. Units that had the highest likelihood of receiving a substantial endowment (such as small districts) contribute the least information to the likelihood.

11. See sec. A2.1 for technical details.

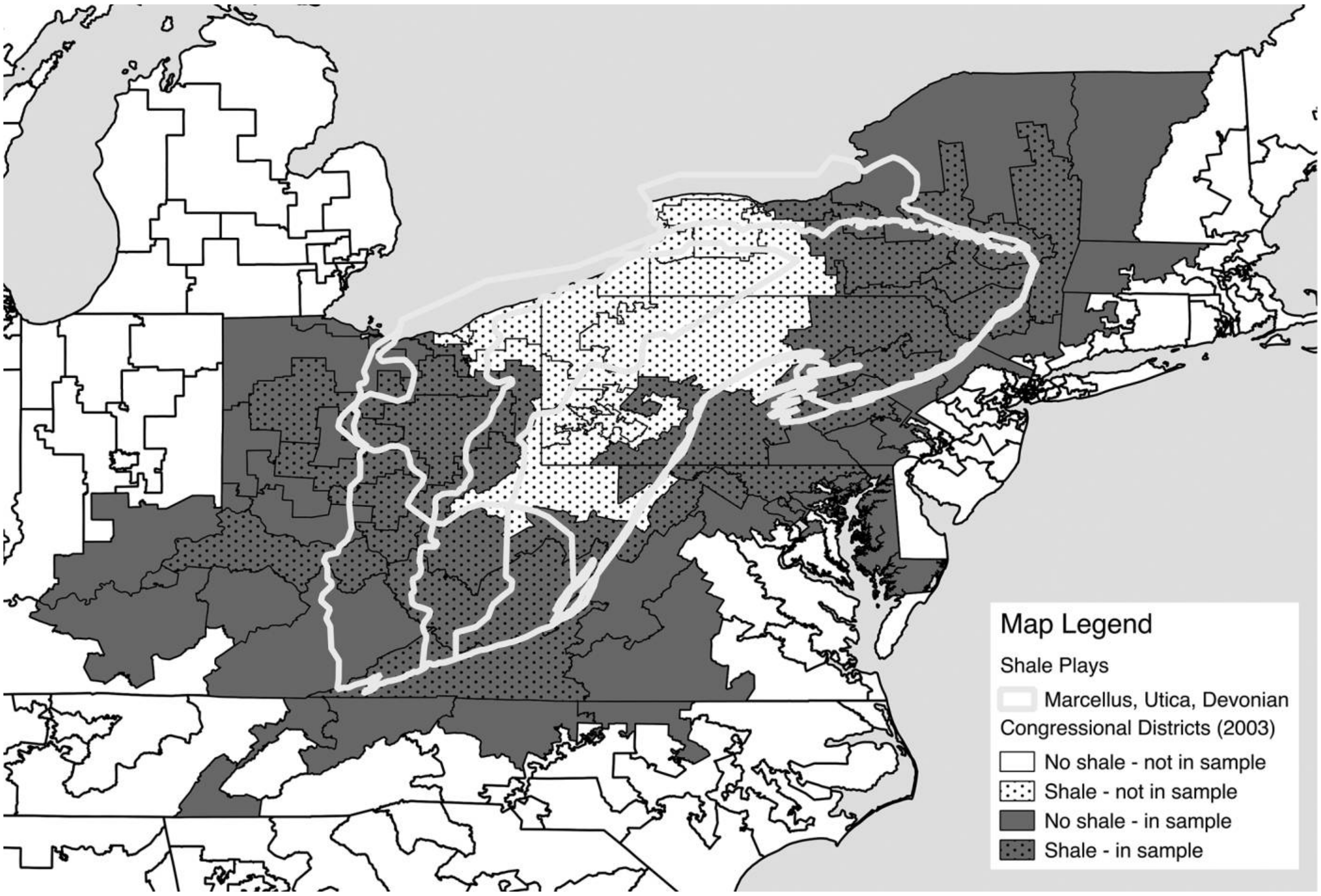

Figure 1. Units included in the main analysis. We only include shale districts that can be paired with a neighboring no-shale district. For this reason, many of the districts in the interior of the interior of the Marcellus are excluded. Further, in models with state-specific time trends, only variation within states is exploited in the estimation.

increasing production levels by the year 2003, our pre-boom period.

We scrutinized the pre-boom exogeneity assumption in three ways. First, we read through journalistic accounts of the shale gas boom, such as McGraw (2011), and found no evidence of widespread interest in shale gas outside Texas by the end of 2004. Specifically, we searched for documented cases of shale gas exploration outside Texas at different times, recording the earliest instances. In Pennsylvania, for example, McGraw (2011) identifies the first limited inquiries by natural gas companies toward the end of the year 2005. As noted above, the Pennsylvania shale boom only began in earnest in 2008 after the Engelder report was published. Second, we conducted a media search for newspaper articles with the word "shale" in the heading. The search shows that there was little interest in shale in mainstream media until the year 2009 (fig. A6). The few articles that began to appear in 2008 were mostly found in Western regional newspapers, and it was only in 2010 that shale gas became a hot topic in the media. Finally, we investigated data on shale gas exploration wells ("spuds") in Pennsylvania, the center of the shale gas boom around Marcellus. While only six wells were drilled in Pennsylvania in 2005, the number reached 1,221 by 2010 and peaked at 1,816 in 2011.[12] Exploration activity in the pre-boom period was minimal even in the most active state in the sample, alleviating concerns about anticipatory effects.

In New York, a de facto moratorium at the state level, along with many formal bans in counties, prevented fracking in the period under consideration. We include New York in our analysis because the new fracking moratorium is endogenous to state politics. Because some specifications include state-specific temporal trends in environmental vot-

12. See FracTracker analysis at http://www.fractracker.org/2015/03/pa-unconventional-production/ (accessed February 1, 2016).

ing, we are able to account for any idiosyncracies in this state in our estimations. When we do exclude New York from the analysis, the estimated effects of shale gas are at least as large and in some specifications larger (table A10).

Bolstering ignorability with differences-in-differences

The ignorability assumption states that, in expectation, the "no-shale" and "shale" potential outcomes of the districts in the study should be equal among those who actually did and did not end up on the shale side of the border. Because we have data on pre-boom and post-boom voting records, we can include district fixed effects in our models and examine how the shale boom changed outcomes relative to the temporal trend in the group of nonshale districts. With year fixed effects included, our design also ensures that any secular trends, such as the rise of the Tea Party and the overall electoral success of Republicans in the 2010 elections, cannot bias our estimates. While this context is worth noting, the trends themselves are considered in the estimation.

This differences-in-differences approach allows us to bolster the ignorability assumption. This is of particular concern as there is some overlap between coal fields and shale deposits, most notably in West Virginia. The fixed effects take account of any features of the districts in our sample that do not vary over time, such as a generally positive or negative disposition toward fossil energy exploitation. We note further that coal exploitation neither grew or declined throughout the study period, as production in major coal states in our sample (Kentucky, Pennsylvania, and West Virginia) remained stable (Foster and Glustrom 2013, 7), and that the districts in our sample on both sides of the border contain a mix of coal and noncoal areas. Our tests of parallel trends further show no pre-shale differences in demographic, social, or economic trends.[13]

To investigate whether the pre-boom voting trends were similar between districts with and without shale deposits, we visualize voting trends over time and formally test this assumption with regression analysis. Figure A4 shows the trend of roll-call votes on the environment in districts with and without shale from 2003 to 2011. Consistent with the quasi-random assignment of shale deposits, in 2003 and 2004 there was no difference in environmental roll-call votes across shale and nonshale districts. Note that our empirical analysis focuses on the years 2003 and 2004 as pre-boom period (when there was almost no awareness of the commercial viability of shale gas at all) and the years 2010 and 2012 as post-boom period. For the average pro-environment votes, we first calculated the yearly average of pro-environment votes in each district in our sample and then averaged it across all districts of the sample. The top-left panel of the figure illustrates the trend in pro-environment voting in all environmental roll-call votes from 2003 to 2011. This exercise suggests that shale and no-shale units moved in the same direction and to the same degree in their trends in the pre-boom period. The other panels looking at the trends of pro-environment voting by a given issue area also show no visible difference between shale and no-shale units with respect to the outcome. Section A2.3 (in the online appendix) shows no evidence against pre-boom parallel trends.

Some specifications include pro-environmental voting trends by state. Because state policies on shale vary, it is useful to allow each state to follow a different temporal trend. Such time trends also allow us to account for state-specific changes in the legislative agenda. They also ensure that our results cannot be driven by differences between nonshale and shale districts across states: when state-specific time trends are included, only variation in shale deposits within each state is used in the estimation. This test is important because some of the nonshale districts have no shale counterpart in their state. Between 2003–4 and 2010–11, the legislative agenda of the Congress changed considerably, and our modeling strategy allows votes from different states to react to these changes in the agenda differently.

Finally, we also conduct a balance test focusing on temporal variation in the pre-shale period (pre-2005). Because the fixed effects specification takes care of any time-invariant imbalances in the sample, the main concern regarding balance is that some time-varying imbalance could be driving results. Using variables matched between the 2000 census and the 2005 American Community Survey (ACS) data, and aggregated to the electoral district level, we were able to assess balance on temporal trends in the units in our main specifications. Specifically, we looked at variables likely to drive changes in voting behavior, such as population growth (total population), social structure (proportion of family households), gender composition (male to female ratio), education and skills (proportion of uneducated males), income trends (median household and per capita), housing trends (proportion of houses greater than USD 80,000 in value), employment (proportion employed in manufacturing) and race (proportion of white). Table A6 presents the results of the balance analysis.

No differences in trends are statistically significant, even without multiple comparisons adjustments to p-values. Substantively, the differences are very small (around 1%–2% in absolute value), with the exception of the percent change in

13. Another possible concern is a spatial correlation between shale gas and conventional oil/gas deposits. Around Marcellus Shale, however, conventional oil/gas production has remained at low levels for decades (see EIA historical data at https://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbblpd_a.htm, accessed September 27, 2016).

the proportion of houses greater than USD 80,000. We show in tables A12 and A13 that this imbalance does not drive our results.

EMPIRICAL RESULTS: SHALE GAS AND ENVIRONMENTAL VOTING IN THE CONGRESS

We first present the main analyses of the effect of shale gas on environmental roll-call votes in the House. The results are presented in table 1. We include binary indicators for shale districts and for the period following the shale boom, as well as their interaction term throughout. The key coefficient is the interaction term, as it compares changes over time between districts with and without shale deposits. Provided our assumptions are met, this coefficient identifies the effect of the shale boom on environmental roll-call votes.

The indicator for shale districts itself does not show any consistent pattern across the estimated models.[14] This result suggests that roll-call votes in districts endowed with shale resources did not show any distinctive pattern prior to the shale boom: in this respect, the districts appear comparable prior to the beginning of shale gas exploration and production. In contrast, access to shale gas appears to put downward pressure on pro-environmental voting after the shale boom. The interaction term, *Shale* × *Post-boom*, the key variable of interest, is negative across all five estimated models. The magnitude of the point estimate ranges from −0.15 to −0.20 and the effects remain substantial and robust to the inclusion of district fixed effects (model 2), state-specific trends (model 3), and to the partisanship of legislator in the pre-boom period (*Rep. in 2004*, models 4 and 5). Substantively, access to shale gas seems to reduce the probability of pro-environmental voting relative to the trend in nonshale districts by 15–20 percentage points.

Predicted probabilities from a simple logistic regression without any fixed effects in tables A14 and A15 confirm the results. The predicted probability of voting for pro-environment is 43% on average in the shale districts in the pre-boom period and 33% in the post-boom period, a 10-percentage point decrease. In nonshale districts, the predicted probability goes to the opposite direction, increasing from 38% to 43%. These changes are consistent with the results from the linear probability models with fixed effects.

14. Whenever district fixed effects are included, we omit the constant and the shale coefficient because they are subsumed by the fixed effects. See sec. A6 for robustness tests that allow the effect of the post-boom shale endowment to depend on the 2003–4 baseline environmental voting record within a district. Figure A9 shows that the results do not vary if we change the sorting rule for deciding whether units are on the shale or no-shale side. In tables A10 and A11, we show that the results are strengthened if we exclude the no-fracking New York State.

These findings suggest that shale resources put downward pressure on environmental policy in the electoral districts bordering the Marcellus Shale play. The negative effects are substantial and stable across the models. Theoretically, shale gas may create demand for environmental policy or pressure to relax regulations if actors with an economic interest in extraction prevail. Our empirical analyses provide support for the latter argument. Some individuals might become more concerned about the environmental damage from fracking, but our results seem to suggest that these concerns are outweighed by the anticipation of economic windfall from fracking.

MECHANISM: BEHAVIORAL OR SELECTION?

Why do we see such change in voting patterns? Does access to natural resources directly influence the behavior of legislators (behavioral mechanism)? Or does it influence the voting pattern through the election of anti-environmental legislators (selection mechanism)? We examine these questions by studying (i) the effects of shale resources on the House of Representatives election outcome, (ii) the narrow versus broad effects of shale on environmental voting, and (iii) the legislative voting pattern in districts that remained in the hands of congressional members of the same party. The first exercise directly tests the selection mechanism by looking at whether the electoral fortunes of anti-environmental legislators are indeed more favorable due to shale access. The second exercise also attempts to shed light on the underlying mechanism: if behavioral change by legislators drives the downward trend on environmental votes, we would only expect to see legislators adjusting their voting only in policy areas related to shale gas extraction, as they respond to demand in the electorate. By contrast, if effects are felt across a range of domains including those unrelated to fracking, this would provide support for the selection mechanism. The third exercise allows us to see if legislators in districts with new access to natural resources change their voting behavior. To foreshadow the results, the evidence strongly suggests that the key mechanism driving the changes in roll-call voting records is the selection mechanism, or the electoral success of Republicans: while there is limited evidence for behavioral changes of legislators who remain in power across elections, the shale boom brings into power Republicans with strong anti-environmental ideologies, who then vote in an anti-environment direction while in office.

Shale gas and electoral fortunes of the Republican party

If the observed effects of shale on the legislative voting pattern are driven by the selection mechanism, candidates with anti-environment preferences—that is, Republicans—should be-

Table 1. Effect of Shale Resource Endowments on Pro-Environmental Voting

Pro-Environmental Vote	(1)	(2)	(3)	(4)	(5)
Shale	.045			−.022	−.101**
	(.104)			(.056)	(.050)
Post-boom	.051	.051	1.042***	.051	1.006***
	(.041)	(.041)	(.195)	(.041)	(.191)
Rep. in 2004				−.502***	−.531***
				(.069)	(.048)
Shale × post-boom	−.149**	−.149**	−.202***	−.149**	−.149**
	(.066)	(.066)	(.071)	(.066)	(.066)
Constant	.383***			.738***	258.494***
	(.065)			(.060)	(51.818)
Dist. FE	No	Yes	Yes	No	No
State trends	No	No	Yes	No	Yes
Adjusted R^2	.008	.410	.434	.256	.366

Note. Electoral districts are defined as assigned to the shale side of the border if at least 20% of the surface area is covered by shale play (viable resources). The model is linear and standard errors are clustered at the district level. Data points are inversely weighted by the district's predicted probability of falling on the shale side of the border, calculated using probit regression of shale assignment on district size. Sample is subsetted to votes that took place in the years 2003, 2004, 2010, and 2011 and to the districts along the border of the shale play. $N = 4{,}180$.
* $p < .1$.
** $p < .05$.
*** $p < .01$.

come more likely to win elections. Employing essentially the same identification strategy as above, we examine the electoral outcomes of districts along the shale border before and after the boom. To estimate the pre-shale electoral trend, pre-boom periods include observations of party membership prior to and immediately after 2004 congressional elections (fig. A3 shows changes in Republican and Democratic representation by district between the pre-boom and post-boom periods). The pre-boom periods include observations in 2003 and 2005. We exclude observations for 2004 because observations from both 2003 and 2004 are determined by the 2002 election, except for one district that held a special election in 2004 out of 55 districts in the sample. The post-boom periods include observations in 2011.

The results presented in table 2 suggest that voters in the shale-affected districts have indeed become more likely to vote for Republican candidates (or less likely to vote for democrats). As the negative coefficient on *Shale* suggests, the shale districts, if anything, were less likely to have Republican members of Congress. Yet, after the awareness of commercial viability of shale gas increased, those same districts have become significantly more likely to have Republican members than nonshale districts, as indicated by the positive coefficient on the interaction term throughout the models. Specifically, based on model 1, the shale districts are estimated to become around 26 percentage points more likely to have Republican members in their House seats compared to the pre-boom period. This effect is robust to the inclusion of district fixed effects and state-specific trends (see table A16 for logistic regressions and table A17 for predicted probabilities). It should be noted that these results are based on the cross-sectional variation in districts on either side of the border: because we are modeling the inter-temporal variation, our findings cannot be attributed to the Republican landslide wins in 2010 or to state-specific tendencies.

The results provide support for the selection mechanism: access to fossil fuel resources benefits anti-environmental candidates. We consistently find the positive effects of shale on the electoral performance of Republicans. As Republicans are less favorable toward environmental causes than Democrats in the American context, these findings on the better electoral performance by Republicans in the shale districts in the post-shale revolution period may suggest that access to fossil fuel resources induces voter preferences toward anti-environmental candidates. Tables A18 and A19 examine the effect of shale gas on the vote share of Republican candidates at the county level; tables A20 and A21, as well as figure A10, illustrate these dynamics in state elections.

Table 2. Effect of Shale Resource Endowments on Party of Member of Congress

Republican in House Seat	(1)	(2)	(3)
Shale	−.140		
	(.130)		
Post-boom	−.088	−.088	−.201*
	(.054)	(.066)	(.106)
Shale × post-boom	.255***	.255**	.350***
	(.096)	(.117)	(.128)
Constant	.735***		
	(.074)		
Dist. FE	No	Yes	Yes
State trends	No	No	Yes
Adjusted R^2	.006	.764	.792

Note. Pre-boom periods include observations of party membership in 2003 and 2005. Post-boom periods include only observations in 2011 following congressional elections of 2010. Model is fitted using a linear probability model, standard errors clustered at district level, and observations inversely weighted by predicted probability of receiving a shale endowment conditional on district size. $N = 165$.
* $p < .1$
** $p < .05$.
*** $p < .01$.

Environmental voting by issue type: Narrow versus broad effects

If the selection mechanism drives the change in legislative voting pattern, we would expect the negative effects of shale gas on a wide range of environmental and energy issues. As the shale boom turns voters toward Republican candidates who are anti-environment in general, shale resources would have an effect on environmental policy ambition unrelated to fossil fuel extraction and use.

We test this expectation by analyzing whether the effects of shale gas differ across the issue areas. By including a triple interaction in table 3, we examine whether the effect appears stronger for roll-call votes related to conventional energy (fossil fuels, nuclear) and weaker for votes irrelevant to energy production. In the upper panel, we include an indicator for votes on conventional energy, interacted with *Shale* and *Post-boom*. The coefficients on the triple interaction term are all negative, suggesting that the negative effects of shale are slightly stronger for votes on conventional energy issues. However, the effects are not large (3.5 percentage points) and the confidence intervals around the coefficients are wide. In the lower panel, we add an indicator for roll-call votes unrelated to energy production, also interacted with *Shale* and *Post-boom*. The triple interaction term for the difference for irrelevant roll-call votes is positive and large (about 8.5 percentage points in all models), but again the confidence intervals are wide. There is no clear evidence for the heterogeneous effect of shale resource endowments on environmental voting by issue domains. Overall, these findings suggest that the effect of access to shale gas resources on pro-environmental voting is not systematically related to the type of issue under consideration by the legislature: the findings are thus consistent with the selection mechanism.

A direct test of the behavioral mechanism

To test the behavioral mechanism more directly, we next explore the voting behavior of legislators in districts that remained in the hands of the same party throughout the period from 2003 to 2011. If the shale effects are driven by the behavioral change of incumbent legislators, we should observe a change in pro-environmental voting even from these districts. In contrast, the selection mechanism does not predict a change in pro-environmental voting in these districts, because the change in voting behavior is mainly driven by the electoral advantage of Republicans.

We reestimate the main models using observations limited to districts where the same party was in office pre- and post-boom periods. It is important to note that these estimates are conditional on a post-treatment outcome, specifically the party of the office-holder, and we should therefore be careful interpreting them as causal. Nevertheless, if the change in environmental voting is driven by behavioral change, a large interaction effect should suggest evidence in favor of the behavioral mechanism. Table 4 presents the results. While significant, the magnitude of the interaction term is small compared to the main results. Thus, the evidence for behavioral change is relatively weak: incumbents who remain in office after the shale gas boom respond to downward pressure only marginally. We infer from these results that the observed change in pro-environmental voting in the shale districts is mainly driven by the selection mechanism.

CONCLUSION

Fossil fuels and other natural resources play an important role in politics due to their economic value and potential for environmental deterioration. Evaluating their effects on politics, however, is difficult because access to these resources is not due to chance alone. We have used the rapid change in access to shale gas resources through fracking in the United States to conduct a quasi-experimental analysis of how a large fossil fuel windfall shapes politics. Specifically, we have investigated how the environmental votes have changed between the years 2003–4 (pre-boom) and 2010–11 (post-boom) around the Marcellus Shale formation. The absence of electoral redistricting during this time in the study

Table 3. Heterogeneous Effect of Shale Resource Endowments on Pro-Environmental Voting by Issue Type

Pro-Environmental Vote	(1)	(2)	(3)	(4)	(5)
Interaction with conventional energy:					
Shale	.048			−.019	−.097**
	(.103)			(.051)	(.049)
Post-boom	.066*	.066*	1.058***	.066*	1.022***
	(.040)	(.040)	(.194)	(.040)	(.190)
Conventional energy	−.011	−.011	−.015	−.011	−.014
	(.018)	(.018)	(.018)	(.018)	(.018)
Rep. in 2004				−.502***	−.531***
				(.069)	(.048)
Shale × post-boom	−.143**	−.143**	−.196***	−.143**	−.143**
	(.067)	(.067)	(.074)	(.067)	(.067)
Conv. energy × post-boom	−.079***	−.079***	−.075***	−.079***	−.075***
	(.022)	(.022)	(.022)	(.022)	(.022)
Conv. energy × shale	−.012	−.012	−.012	−.012	−.012
	(.042)	(.043)	(.043)	(.042)	(.042)
Conv. energy × shale × post-boom	−.035	−.035	−.035	−.035	−.035
	(.044)	(.044)	(.044)	(.044)	(.044)
Constant	.386***			.741***	259.082***
	(.062)			(.059)	(51.718)
Dist. FE	No	Yes	Yes	No	No
State trends	No	No	Yes	No	Yes
Adjusted R^2	.014	.416	.440	.262	.372
Interaction with Irrelevance Indicator:					
Shale	.045			−.022	−.101**
	(.106)			(.058)	(.051)
Post-boom	.060	.060	.946***	.060	.910***
	(.041)	(.042)	(.190)	(.041)	(.187)
Irrelevant	.203***	.203***	.158***	.203***	.160***
	(.056)	(.056)	(.057)	(.056)	(.057)
Rep. in 2004				−.502***	−.531***
				(.069)	(.048)
Shale × post-boom	−.155**	−.155**	−.208***	−.155**	−.155**
	(.066)	(.067)	(.071)	(.066)	(.066)
Irrelevant × post-boom	−.133**	−.133**	−.145**	−.133**	−.144**
	(.066)	(.067)	(.067)	(.067)	(.066)
Irrelevant × shale	.001	.001	.003	.001	.001
	(.083)	(.084)	(.084)	(.083)	(.083)
Irrelevant × shale × post-boom	.085	.085	.086	.085	.085
	(.105)	(.105)	(.105)	(.105)	(.105)
Constant	.370***			.725***	229.954***
	(.066)			(.061)	(50.669)
Dist. FE	No	Yes	Yes	No	No
State trends	No	No	Yes	No	Yes
Adjusted R^2	.015	.416	.437	.263	.369

Note. The models from table 1 have an interaction term added, which indicates how the main shale effect varies by the type of roll-call vote. The upper panel shows product terms for votes on conventional energy (fossil fuels, nuclear power). The lower panel shows votes product terms for topics unrelated to energy production: wildlife, oceans, transportation. Same models and standard errors estimated as in table 1. $N = 4{,}180$.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

Table 4. Effect of Shale Resource Endowment on Environmental Voting in Districts Where Representatives of the Same Party Were Been in Office from the Pre-Shale to the Post-Shale Period

Pro-Environmental Vote	(1)	(2)	(3)	(4)	(5)
Shale	.102			−.009	−.050
	(.152)			(.036)	(.050)
Post-boom	.013	.013	.182	.013	.208
	(.019)	(.020)	(.134)	(.019)	(.129)
Republican				−.743***	−.679***
				(.050)	(.064)
Shale × post-boom	−.077*	−.077*	−.035	−.077*	−.077*
	(.044)	(.044)	(.050)	(.044)	(.044)
Constant	.361***			.877***	53.215
	(.084)			(.040)	(34.277)
Dist. FE	No	Yes	Yes	No	No
State trends	No	No	Yes	No	Yes
Adjusted R^2	.005	.583	.586	.542	.553

Note. Same models and standard errors estimated as in table 1. $N = 2{,}584$.
* $p < .1$.
** $p < .05$.
*** $p < .01$.

area enables us to compare differing trends in environmental voting across shale and nonshale electoral districts. We have also provided theory and evidence in support of the contention that the change in voting is driven by the electoral performance of Republicans in areas with access to shale gas.

These findings show how resource windfalls shape the incentives, behavior, and electoral fortunes of elected officials. The local winners from shale gas extraction dominate politics over shale gas. Shale gas thus creates a local resource curse by encouraging elected officials to relax environmental policies, which undermines the state's ability to control negative externalities. In polarized legislatures, in which legislators vote in a highly "constrained" (Converse 1964) manner, the very existence of fossil fuel resources may thus contribute to the weakening of environmental governance, as anti-environmental candidates dominate elections. In the United States, the downward pressures generated by a natural resource windfall apply to environmental and energy policies across the board. In a less polarized society with a partisan consensus on environmental issues, such broad downward effects could fail to materialize. In such contexts, we might expect candidates to win office by campaigning on a pro-shale platform, without their necessarily being constrained to vote in any particular way on the regulation of other issues, such as oceans and wildlife. Within the United States, polarization at the state, or even local, level might condition the broad effects of narrow conflicts over natural resource windfalls.

We thus consider the empirical analysis of the political and policy effects of windfalls in different social, cultural, and institutional settings an important frontier for the study of the political economy of natural resources and the environment. While there is now a large body of literature on the resource curse, our findings show that even in a context characterized by liberal democracy and electoral accountability, natural resource windfalls can produce large changes in leaders' environmental policy preferences, perhaps even leading to the underprovision of regulations. While Goldberg, Wibbels, and Mvukiyehe (2008, 493) argue "that political incumbents in resource-abundant polities with fair and free elections manage to win by larger margins and preserve vote shares in the face of adverse circumstances in a way that politicians without access to mineral rents will not," we show that the effect of natural resource windfalls can be more complicated than that, as voters turn against incumbents with pro-environmental preferences. Given the increased public salience of natural resources, and fossil fuels in particular, at a time of rapid climate change, the impact of natural resource windfalls on policies and politics is an important frontier for research.

Our empirical strategy is also suited for examining other outcomes, such as public opinion, provided that researchers can conduct fine-grained surveys at the district level. Another natural direction for future research concerns the applicability of our findings to other conflicts over natural resources. In the case of the American shale revolution, the economic stakes were high—especially in the aftermath of the 2008 financial crisis—and the uncertainties surrounding the environmental externalities considerable. Moreover, some environmentalists preferred shale gas to coal for reasons of climate mitigation. Thus, examining other cases, such as mining or forestry, could prove interesting insights into the generalizability of our results on the broad impacts of narrow conflicts.

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REFERENCES

Aldrich, Daniel P. 2008. *Site Fights: Divisive Facilities and Civil Society in Japan and the West*. Ithaca, NY: Cornell University Press.

Allcott, Hunt, and Daniel Keniston. 2014. "Dutch Disease or Agglomeration? The Local Economic Effects of Natural Resource Booms in Modern America." Working paper no. 20508, National Bureau of Economic Research, Cambridge, MA.

Angrist, Joshua D., and Jörn-Steffen Pischke. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton, NJ: Princeton University Press.

Ansolabehere, Stephen, and David M. Konisky. 2014. *Cheap and Clean: How Americans Think about Energy in the Age of Global Warming*. Cambridge, MA: MIT Press.

Calonico, Sebastian, Matias D. Cattaneo, and Rocio Titiunik. 2014. "Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs." *Econometrica* 82 (6): 2295–326.

Cheon, Andrew, and Johannes Urpelainen. 2013. "How Do Competing Interest Groups Influence Environmental Policy? The Case of Renewable Electricity in Industrialized Democracies, 1989–2007." *Political Studies* 61 (4): 874–97.

Converse, Philip E. 1964. "The Nature of Belief Systems in Mass Publics." In *Ideology and Its Discontents*, ed. David E. Apter. New York: Free Press.

Cust, James, and Steven Poelhekke. 2015. "The Local Economic Impacts of Natural Resource Extraction." *Annual Review of Resource Economics* 7 (October): 251–68.

Davis, Charles. 2012. "The Politics of 'Fracking': Regulating Natural Gas Drilling Practices in Colorado and Texas." *Review of Policy Research* 29 (2): 177–91.

Deutch, John. 2011. "The Good News about Gas: The Natural Gas Revolution and Its Consequences." *Foreign Affairs* 90 (1): 82–93.

Dunlap, Riley E., Chenyang Xiao, and Aaron M. McCright. 2001. "Politics and Environment in America: Partisan and Ideological Cleavages in Public Support for Environmentalism." *Environmental Politics* 10 (4): 23–48.

Fedaseyeu, Viktar, Erik Gilje, and Philip E. Strahan. 2015. "Voter Preferences and Political Change: Evidence from Shale Booms." Working paper no. 21789, National Bureau of Economic Research, Cambridge, MA.

Fetzer, Thiemo. 2014. "Fracking Growth." Working paper no. 1278, Centre for Economic Performance, London School of Economics and Political Science.

Foster, Teresa, and Leslie Glustrom. 2013. "Trends in US Coal Production: 1990–2012." Working paper, Clean Energy Action, Boulder, CO.

Gerber, Alan S., and Donald P. Green. 2012. *Field Experiments: Design, Analysis, and Interpretation*. New York: Norton.

Goldberg, Ellis, Erik Wibbels, and Eric Mvukiyehe. 2008. "Lessons from Strange Cases: Democracy, Development, and the Resource Curse in the US States." *Comparative Political Studies* 41 (4–5): 477–514.

Grossman, Gene M., and Elhanan Helpman. 1994. "Protection for Sale." *American Economic Review* 84 (4): 833–50.

Hardin, Garrett. 1968. "The Tragedy of the Commons." *Science* 162:1243–48.

Hardy, Kirsten, and Timothy W. Kelsey. 2015. "Local Income Related to Marcellus Shale Activity in Pennsylvania." *Community Development* 46 (4): 329–40.

Hausman, Catherine, and Ryan Kellogg. 2015. "Welfare and Distributional Implications of Shale Gas." Working paper no. 21115, National Bureau of Economic Research, Cambridge, MA.

Howarth, Robert W., Renee Santoro, and Anthony Ingraffea. 2011. "Methane and the Greenhouse-Gas Footprint of Natural Gas from Shale Formations." *Climatic Change* 106 (4): 679–90.

Keele, Luke J., and Rocio Titiunik. 2015. "Geographic Boundaries as Regression Discontinuities." *Political Analysis* 23 (1): 127–55.

Layman, Geoffrey C., Thomas M. Carsey, and Juliana Menasce Horowitz. 2006. "Party Polarization in American Politics: Characteristics, Causes, and Consequences." *Annual Review of Political Science* 9:83–110.

LCV (League of Conservation Voters). 2013. "2013 National Environmental Scorecard: First Session of the 113th Congress." Presented at the League of Conservation Voters, Washington, DC.

Lee, David S. 2008. "Randomized Experiments from Non-random Selection in US House Elections." *Journal of Econometrics* 142 (2): 675–97.

Mallinson, Daniel J. 2014. "Upstream Influence: The Positive Impact of PAC Contributions on Marcellus Shale Roll-Call Votes in Pennsylvania." *Interest Groups and Advocacy* 3 (3): 293–314.

McAdam, Doug, and Hilary Boudet. 2012. *Putting Social Movements in Their Place: Explaining Opposition to Energy Projects in the United States, 2000–2005*. New York: Cambridge University Press.

McCright, Aaron M., Chenyang Xiao, and Riley E. Dunlap. 2014. "Political Polarization on Support for Government Spending on Environmental Protection in the USA, 1974–2012." *Social Science Research* 48 (November): 251–60.

McGraw, Seamus. 2011. *The End of Country: Dispatches from the Frack Zone*. New York: Random House.

Muehlenbachs, Lucija, Elisheba Spiller, and Christopher Timmins. 2014. "The Housing Market Impacts of Shale Gas Development." Working paper no. 19796, National Bureau of Economic Research, Cambridge, MA.

Newell, Richard G., and Daniel Raimi. 2014. "Implications of Shale Gas Development for Climate Change." *Environmental Science and Technology* 48 (15): 8360–68.

Olson, Mancur. 1965. *The Logic of Collective Action: Public Goods and the Theory of Groups*. Cambridge, MA: Harvard University Press.

Ostrom, Elinor. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. New York: Cambridge University Press.

Rabe, Barry G. 1994. *Beyond NIMBY: Hazardous Waste Siting in Canada and the United States*. Washington, DC: Brookings.

Rabe, Barry G. 2014. "Shale Play Politics: The Intergovernmental Odyssey of American Shale Governance." *Environmental Science and Technology* 48 (15): 8369–75.

Rabe, Barry G., and Christopher Borick. 2013. "Conventional Politics for Unconventional Drilling? Lessons from Pennsylvania's Early Move into Fracking Policy Development." *Review of Policy Research* 30 (3): 321–40.

Ross, Michael L. 1999. "The Political Economy of the Resource Curse." *World Politics* 51 (2): 297–322.

Skovron, Christopher, and Rocío Titiunik. 2015. "A Practical Guide to Regression Discontinuity Designs in Political Science." Working paper, University of Michigan.

Stigler, George J. 1971. "The Theory of Economic Regulation." *Bell Journal of Economics and Management Science* 2 (1): 3–21.

Stokes, Leah C. 2015. "Electoral Backlash against Climate Policy: A Natural Experiment on Retrospective Voting and Local Resistance to Public Policy." *American Journal of Political Science* 60 (4): 958–74.

Venkatesh, Aranya, Paulina Jaramillo, W. Michael Griffin, and H. Scott Matthews. 2012. "Implications of Changing Natural Gas Prices in the United States Electricity Sector for SO_2, NO_X and Life Cycle GHG Emissions." *Environmental Research Letters* 7 (3): 034018.

Vidic, Radisav D., Susan L. Brantley, Julie M. Vandenbossche, David Yoxtheimer, and Jorge D. Abad. 2013. "Impact of Shale Gas Development on Regional Water Quality." *Science* 340 (6134): 1235009.

Wang, Zhongmin, and Alan Krupnick. 2013. "A Retrospective Review of Shale Gas Development in the United States." Discussion paper 13-12, Resources for the Future, Washington, DC.