# FUEL FOR DEBATE: THREE STUDIES OF THE POLITICAL MOBILIZATION FOR AND AGAINST HYDRAULIC FRACTURING IN NEW YORK STATE

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# FUEL FOR DEBATE: THREE STUDIES OF THE POLITICAL MOBILIZATION FOR AND AGAINST HYDRAULIC FRACTURING IN NEW YORK STATE

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This dissertation uses the context of the unfolding boom in oil and gas production enabled by hydraulic fracturing ("fracking") technology to ask several interrelated questions: What motivates people to oppose or support industrial development? How do material interests interact with political identities to shape political mobilization? What consequences does this political contestation have for policymaking? Three stand-alone articles, each using unique data and methods, provide new evidence for answering these questions. The three studies place a common emphasis on the multiple meanings that fracking has for opponents and supporters of proposed development as well as the alternative structural conditions that give rise to the divergent beliefs and the social networks that facilitate mobilization. The first article, examines the passage of local zoning ordinances prohibiting fracking and identifies spatial and temporal processes that influenced the pattern of ordinance adoption. The second article, looks more closely at political mobilization for and against hydraulic fracturing by examining individual-level data collected from one town's debate over a proposed ban on oil and gas development. The third article uses a large set of public comments to directly examine the meanings that the public attached to hydraulic fracturing and whether residents who live in close proximity to proposed development understood the industry in systematically different terms than individuals who participated in the debate despite facing little or no direct impact from fracking.

# BIOGRAPHICAL SKETCH

Fedor A. Dokshin was born in Kirovsk, Russia and grew up in Southeast Michigan after immigrating to the United States with his family at age 10. He received a Bachelor of Arts degree in Sociology and Government from Cornell University. Before returning to Ithaca to begin his doctoral studies at Cornell, Fedor spent a year in Germany enrolled at the University of Heidelberg. His doctoral research has spanned the areas of organizations, social networks, and social movements. His work has been published in the *American Sociological Review*, *Social Forces*, and *Nature Human Behaviour*. He began a position as Assistant Professor of Sociology at the University of Toronto in July 2017.

I dedicate this dissertation to my parents, Lyudmina Dokshina and Aleksandr Dokshin. Without their sacrifices, it would not be possible.

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My parents, Luda and Alex; my brother, Greg; and my sister, Dasha were endlessly supportive. They were understanding on those occasions when my work got the better of me. My family helped me keep the important things in perspective as we navigated some challenging times together over the last several years.

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# INTRODUCTION TO THE DISSERTATION

This dissertation uses the context of the unfolding boom in oil and gas production enabled by hydraulic fracturing ("fracking") technology to ask several interrelated questions: What motivates people to oppose or support industrial development? How do material interests interact with political identities to shape political mobilization? What direct and indirect consequences does political contestation have for policymaking, the distribution of environmental risk, and the emergence of new energy industries? The three dissertation articles (and a related non-dissertation article) contain partial answers these questions. Equally important, the articles bring the questions into sharper focus and suggest new lines of research.

Though usually implicitly, the articles are anchored with a common micro-level account of political mobilization that bridges structural and cultural explanations. This account emphasizes the multiple meanings that fracking has for opponents and supporters of proposed development as well as the alternative structural conditions that give rise to the divergent beliefs and the social networks that facilitate mobilization.

The first article, "Whose Backyard and What's at Issue? Spatial and Ideological Dynamics of Local Opposition to Fracking in New York State, 2010-2013," examines the passage of local zoning ordinances prohibiting fracking. I find that early adoption of laws reflected competing local visions of the industry put forward by NIMBY and PIMBY activists. As fracking became the subject of highly politicized national debates, however, local opposition increasingly reflected mobilization by political liberals. This trend is evident in the increasing rate of ban adoption among Democratic-leaning communities, including those that do not lie on any gas-bearing shale formations and thus face no direct threat from fracking. The article

contributes to recent scholarly debates about the influence of partisan polarization on political participation and policymaking.

The second article, "Party over Town and Country: Explaining Mobilization for and against Hydraulic Fracturing among Residents of a Rural Community" looks more closely at political mobilization for and against hydraulic fracturing by examining individual-level data collected from one town's debate over a proposed ban on oil and gas development. The analysis shows that material interests of local residents influenced their probability of speaking out on the issue, but political identity was the overwhelming factor that structured the pattern of mobilization.

The third article uses a large set of public comments to directly examine the meanings that the public attached to hydraulic fracturing and whether residents who live in close proximity to proposed development understood the industry in systematically different terms than individuals who participated in the debate despite facing little or no direct impact from fracking. The descriptive results provide support for the intuition that opponents of fracking were drawn from distinct social bases. The study opens up a line of research that will examine the social factors that predict the alternative conceptions of controversial industries.

Lastly, I wish to mention a related article that is not part of the dissertation, but addresses a key element of the theoretical puzzle raised in the dissertation (Dokshin and Buday 2017). This article, titled "Not in Your Backyard! Partisanship, Organizational Structure, and the Mobilization of Conscience Constituents against Hydraulic Fracturing in Illinois, 2013-2014," investigates the organizational factors that enabled Democratic partisans to assume an increasingly prominent role in the anti-fracking movement, and in the process transformed it from a relatively parochial contest over local zoning into a national movement. Marshaling

evidence at the community, organizational, and individual levels, we show that a network of large, multi-issue advocacy organizations mobilized Democratic partisans to oppose fracking irrespective of their proximity to proposed oil and gas development. We connect our findings to a broader trend in contemporary political advocacy in the U.S. toward supply-side recruitment strategies, wherein multi-issue advocacy organizations use new mobilizing technologies to continually introduce new issues to highly motivated partisan activists.

The dissertation makes several notable methodological contributions. The second dissertation article pioneers a new approach to studying political mobilization at the individual level by merging data from multiple administrative datasets. The third dissertation article and the fourth, related article introduce public comments as a new source of data for studying public response to industrial projects. These data are uniquely useful because they (1) offer a behavioral measure of both opposition and support of an industry; (2) they can be geocoded, allowing for precise measurement of the participant's proximity to proposed industrial sites; (3) they contain detailed accounts of the conceptions of industrial siting that people hold; and (4) they include information on the organizations that helped mobilize opposition and support. Finally, I advance the application of natural language processing and machine learning methods for deriving meaning from large corpora of text to social scientific questions.

**Whose Backyard and What's at Issue? Spatial and Ideological Dynamics of Local Opposition to Fracking in New York State, 2010 to 2013**

**ABSTACT**

What drives local decisions to prohibit industrial land uses? This study examines the passage of municipal ordinances prohibiting gas development using hydraulic fracturing ("fracking") in New York State. I argue that local action against fracking depended on multiple conceptions of the shale gas industry. Matching these alternative conceptions with prevailing spatial models of public response to industrial land uses—"not in my backyard," "not in anyone's backyard," and "please in my backyard"—improves our understanding of where local contention might emerge and how it contributes to policy change. Results from event history and logistic regression analyses show, first, that communities lying above favorable areas of the shale did not pass anti-fracking laws because opposition to fracking was counteracted by significant local support for development. Fracking bans passed primarily in a geographic sweet spot on the periphery of targeted regions, where little or no compelling economic interest in development existed. Second, as fracking became the subject of a highly politicized national debate, local opposition increasingly reflected mobilization by political liberals. This trend is reflected in the increasing rate of ordinance adoption among Democratic-leaning communities outside the geographic sweet spot.

## INTRODUCTION

Understanding local responses to industrial projects is of long-standing interest to social scientists (Freudenburg and Pastor 1992; Slovic 1987). Divergent community responses to industrial siting contribute to the unequal distribution of health and environmental hazards (Gaventa 1980; Pais, Crowder, and Downey 2014; Saha and Mohai 2005) and shape the emergence and diffusion of new technologies and industries (Sine and Lee 2009; Walsh, Warland, and Smith 1997).

Prohibiting an industrial siting requires mobilization of a critical mass of local residents, with sufficient resources, who share a common interest in stopping the proposed development. Traditionally, researchers refer to industrial projects as locally unwanted land uses (LULUs) and describe opposition to them as being motivated by "not in my backyard" (NIMBY) attitudes (Freudenburg and Pastor 1992; Schively 2007). Recent scholarship, however, finds significant variation in residents' perceptions of proposed sitings. Some residents focus on the negative impacts of a proposed siting (Esaiasson 2014), others emphasize its economic benefits (Jerolmack and Walker 2016; Kunreuther and Easterling 1996), and many never develop or express a clear position one way or another (Boudet et al. 2014). These perceptions (and non-perceptions) of risk and benefit, moreover, do not only depend on local opinion about potential impacts, but may also reflect politicized debates about the industry that occur in the broader public sphere (Gamson and Modigliani 1989; Jenkins-Smith et al. 2011; McAdam and Boudet 2012; Michaud, Carlisle, and Smith 2008). Although we know people develop different conceptions of industrial projects, we know little about how these conceptions trigger mobilization and contribute to local decisions to restrict industrial land uses.

I argue that different conceptions of risks and benefits of industrial projects correspond to alternative bases of opposition and support, and delineating these alternative bases is key to explaining why some communities ban industrial land uses and others do not. I highlight two important distinctions in how community residents understand industrial projects. First, risk from an industrial project provides motivation for NIMBY opposition, but in contexts where economic benefits of industrial projects can be credibly framed, some community residents may express support even for risky projects (Boudet et al. 2016; Gravelle and Lachapelle 2015). Successful opposition thus depends on overcoming resistance from industry supporters, which will vary across different community contexts. Second, in addition to perceived local impacts, when an industry is politicized in national debates, ideology or political identity will provide an alternative basis for opposition (Michaud et al. 2008). Reflecting a "not in anyone's backyard" (NIABY) attitude, opposition based on political identities is less geographically constrained.

I test these arguments in an event history analysis of adoptions of zoning ordinances prohibiting hydraulic fracturing ("fracking") in New York State. Fracking refers to the process of stimulating oil and gas wells by pumping liquid into the well at high pressure. The liquid, containing water, a mix of chemicals, and sand particles, shatters the rock and helps release the oil or gas locked inside. Technological innovations in horizontal drilling and fluid mechanics have expanded the potential of fracking for developing oil and gas reserves in the United States (Wilber 2012). This new technique is often called high-volume hydraulic fracturing (HVHF), to distinguish it from a technique that has been used in the industry since the 1940s, but on a much smaller scale. Use of HVHF has fueled a veritable energy revolution in the United States (Levi 2013; Wilber 2012). The technology is the main reason why the United States is projected to become a net energy exporter by 2019 for the first time since the 1950s (U.S. Energy

Information Administration 2015). But fracking has also provoked intense opposition in some communities (Vasi et al. 2015). The tactic of banning fracking at the municipal level, in particular, counts as a significant threat to the burgeoning oil and gas industry across the United States, with local ban campaigns recently spreading to key oil- and gas-producing states (Healy 2015).

The municipal fracking ban movement is important in its own right, but the setting also provides an ideal opportunity to advance research in environmental sociology and social movement scholarship. First, the sudden emergence of the shale gas industry allows me to examine local responses by hundreds of communities, which were put at varying degrees of risk by their proximity to proposed shale gas development, and whose residents faced different prospects of economic rewards from the development (Jacquet and Stedman 2011; Jerolmack and Walker 2016; Wilber 2012). I find that proximity to proposed gas wells, by structuring where risk and reward could be credibly framed, is a key predictor of whether a community adopted an ordinance. Strikingly, fracking bans rarely passed in regions most likely to see intense development, but they proliferated in a geographic sweet spot on the periphery of potential development regions. In these communities, little or no compelling economic interest in development existed, but residents still perceived potential risk and thus compelled their town boards to pass protective ordinances. By contrast, local fights over fracking were highly divisive in the most favorable shale region, reflecting competing visions of gas development. Primary data on public participation in one town suggests that local support for fracking was significant and concentrated among large landowners.

Second, the setting provides a unique opportunity to examine the effect of an issue's politicization on social movement mobilization and local policy change (Heaney and Rojas 2015;

Kahan, Jenkins-Smith, and Braman 2011). During the period of the local ban movement, shale gas development emerged from a local land use issue to become the subject of intense national debate (Boudet et al. 2014; Mazur 2016; Vasi et al. 2015). I leverage this temporal trend to show that the politicization of fracking led to a compositional change among fracking opponents. Locally perceived threats and benefits continued to be important, but as the issue gained broader public attention, the adoption of ban ordinances increasingly reflected mobilization by Democratic partisans.

## EXPLAINING LOCAL DECISIONS TO PROHIBIT INDUSTRIAL PROJECTS

### *Local Sources of Opposition to and Support for Industrial Siting*

One important thread in existing research on industrial siting is that the nature of public response reflects residents' beliefs about *local* impacts associated with the proposed siting. Perhaps the most influential explanation of opposition to industrial siting is that residents are motivated by their self-interest to oppose projects. This view, embodied in the NIMBY ("not in my backyard") framework, holds that residents perceive that a siting will adversely affect their quality of life, their health, or their property values, and they mobilize to prevent this from happening (Esaiasson 2014; Kraft and Clary 1991; Schively 2007).

Observing that residents do not always respond with opposition when faced with a risky project, recent scholarship has shifted the analytic focus to include factors that may inhibit the emergence of opposition (e.g., McAdam and Boudet 2012). Researchers have drawn on studies of risk perception under uncertainty (e.g., Slovic 1987) to argue that some elements of community context facilitate perceptions of threat, whereas other elements predispose community members toward inaction (Auyero and Swistun 2008; McAdam and Boudet 2012).

For instance, objective conditions, such as economic vulnerability and previous experience with the proposed industry, may decrease the chances that a siting is perceived as a threat (see Wright and Boudet 2012). Similarly, subjective dimensions, such as place attachment (Devine-Wright 2009) and place history (Auyero and Swistun 2008; Molotch, Freudenburg, and Paulsen 2000) influence residents' responses.

Although scholars have given less attention to local support for industrial projects, there is evidence that residents sometimes develop positive conceptions of a project through emphasizing its (usually economic) benefits (e.g., Boudet et al. 2016; Gravelle and Lachapelle 2015; Jerolmack and Walker 2016). Most directly, compensation to residents near a sited facility can win their acceptance of a project (Kunreuther and Easterling 1996). Other research finds that residents are more likely to support projects that promote local ownership of the facilities (Devine-Wright 2005; Warren and McFadyen 2010). The extensive literature on boomtowns finds that enthusiasm for new development is a common stage experienced by local residents, especially in economically vulnerable communities (Gilmore 1976; Thompson and Blevins 1983). In summary, for both opposition and support, the distribution of perceived local impacts critically shapes the pattern of public response to a proposed industrial project.

*Industry Politicization and Ideological Bases of Public Response*

Although much existing research focuses on the perceptions of local impacts from industrial projects, scholars have also observed that the siting of many types of industries is amenable to being framed as an issue of broad popular concern (Boudet 2011; Gamson and Modigliani 1989; Michaud et al. 2008; Rootes 2013). Rather than a response to perceived local impacts, opposition

may instead be grounded in political identities or ideological commitments and organized by non-local actors (McAdam and Boudet 2012; Michaud et al. 2008; Rootes 2013).

Previous studies show that connecting a siting dispute with more general issues of environmental management may help local opponents enlist a broader set of constituents, spread opposition to a wider geographic area, and ultimately increase the chances of success (Boudet 2011; McAdam and Boudet 2012; Walsh et al. 1997). Research finds that people use partisan identification and ideology as essential lenses to process information about new industries and form opinions about them (Boudet et al. 2014; Davis and Fisk 2014; Gravelle and Lachapelle 2015; Jenkins-Smith et al. 2011; Michaud et al. 2008). In a study that directly compares NIMBY and ideological bases of opposition to industrial siting, Michaud and colleagues (2008) find no evidence that proximity predicts opposition to offshore drilling among California residents, but they do find that negative attitudes are strongly related to several measures of political orientation. They conclude that politicized, national discourse about the oil industry motivated Democratic partisans to oppose the drilling.

Partisan opposition to new industries is part of a broader trend in the contemporary United States toward the increased importance of partisan identities for structuring political opinions and political activism (Feinberg and Willer 2013; Heaney and Rojas 2015; Kahan et al. 2011; McCright and Dunlap 2011). U.S. citizens' positions on one issue are increasingly predictive not only of their ideology and partisan identity (Baldassarri and Gelman 2008), but also of their lifestyle choices and cultural affinities (DellaPosta, Shi, and Macy 2015). Taking a stand on a politicized issue can be less about the perceived risks and benefits, and more about affirming the kind of person you are (Feinberg and Willer 2013; Kahan et al. 2011). The implication for research on public response to industrial projects is that politicized discourse

about an industry helps redefine the perceived stakes of the issue and thereby supplements local perceptions of risk as the basis for opposition.

*Alternative Conceptions, Geography, and Local Policy Change*

Research has identified different conceptions of industrial projects, but scholars have paid little attention to how these alternative conceptions collectively shape local land use decisions. I emphasize the distinction between opponents and supporters of industrial projects and between local and politicized conceptions of industrial impacts. Combining this with spatial models of public response to industrial siting suggests specific expectations about where opposition emerges and where it leads to local decisions to prohibit industrial land uses.

Scholars conceive of public response to industrial projects in spatial terms but disagree about the key relationship—geographic proximity to the proposed site and opposition. From one major perspective, most evocatively associated with the "not in my backyard" (NIMBY) framework, industrial projects are understood as local grievances, suggesting that opposition should concentrate in the immediate proximity of the proposed project (e.g., Esaiasson 2014). Several studies, however, find evidence of a "please in my backyard" (PIMBY) effect,[1] wherein residents closer to a siting are actually more likely to accept or support it (e.g., Boudet et al. 2016; Gravelle and Lachapelle 2015; Jerolmack and Walker 2016). Still other scholars offer a "not in anyone's backyard" (NIABY) account, based on research that finds little or no effect of proximity on opposition but a strong effect of political identities (e.g., Michaud et al. 2008).

Findings of these different spatial patterns are often treated as evidence for competing explanations, but perhaps they are better seen as complementary—reflecting the fact that people oppose (and support) industrial projects for different reasons. In particular, political identity and

perceived local impacts (positive and negative) may provide alternative bases of opposition or support, which give rise to different *types* of opponents and supporters. Gould (1995) stresses the theoretical importance of delineating alternative social bases of mobilization, arguing that explaining mobilization requires specifying the social identification that defines a person's interests within a specific contentious episode and furnishes one with motivation and a sense of obligation to mobilize. A key implication of this theoretical point is that important distinctions can be drawn not only between opponents and supporters, but also among participants on the same side of the conflict.[2] In the context of industrial siting, opponents may, for example, mobilize as members of a bedroom community whose sense of place is incompatible with industrial development (Devine-Wright 2009), or as political liberals who view their opposition as an extension of their environmentalist ideology (Michaud et al. 2008). The researcher's task is to unpack the alternative social bases that underlie mobilization on either side of a particular siting conflict and show which of the alternative appeals for mobilization can be credibly framed under the local conditions (Walder 2009; Wright and Boudet 2012).

From this perspective, the conflicting findings about the *average* effect of proximity on public response may conceal important heterogeneity of the effect by type of opponent or supporter. Gravelle and Lachapelle's (2015) study of public attitudes toward the Keystone XL pipeline illustrates this heterogeneity in the context of a highly politicized industrial project. They find that residents in close proximity to the pipeline's route tend to favor the project. This result, which is evidence for a PIMBY effect, holds irrespective of political orientation. However, with greater distance from the pipeline route, liberal, but not conservative, respondents' attitudes turn negative, suggesting the presence of a NIABY-style opposition rooted in a liberal political orientation. Gravelle and Lachapelle suggest that proximate residents'

greater knowledge of localized economic benefits from the pipeline supplanted an ideological response. More generally, we expect people will express and act upon alternative conceptions of industrial projects, and these alternative conceptions have unique geographic signatures: NIMBY, PIMBY, and NIABY.

Geographic proximity is therefore an important variable for understanding public response to industrial projects, but its effect is conditioned by (1) evaluation of localized risks and benefits and (2) broader political debates that legitimize opposition or support as expressions of political identity. To understand where opposition to an industrial project might be successful requires us to consider how these alternative bases of opposition and support intersect within individual communities.

Opposition based on local conceptions is most likely to develop when a project's risks can be credibly framed in the local context (Wright and Boudet 2012). Similarly, local support should concentrate where a project's economic benefits are salient. The size of the "backyard" (i.e., the relative geographic scale at which the risks or benefits are perceived) may be different for NIMBY and PIMBY responses, but both responses are a function of proximity to proposed development (Gravelle and Lachapelle 2015; Jacquet 2012). On the other hand, opposition based on politicized conceptions of industries will be less constrained by proximity to an actual project. Instead, in a given community, the strength of this NIABY-style opposition depends, first, on the prevalence of public debate that effectively frames the industry in ways that resonate with salient political identities (Benford and Snow 2000; Jenkins-Smith et al. 2011) and, second, on the volume of local residents who hold the relevant political identity.

## NEW YORK STATE AND THE SHALE GAS REVOLUTION

The recent emergence of fracking, or HVHF, technology has unlocked "unconventional" oil and gas reserves, most notably in shale rock formations deep beneath the earth's surface. Among the sources of natural gas that fracking has made accessible, the Marcellus Shale formation, a massive rock deposit underlying a large area of the American Northeast, is the most impressive (Engelder 2009; Wilber 2012). Pennsylvania, where the geology and regulatory environment were most favorable, became an early leader in producing shale gas from the Marcellus. Buoyed by impressive production reports from Pennsylvania, enthusiasm for Marcellus gas quickly spilled across the border into New York. By 2007, gas companies were aggressively leasing acreage in the state, particularly in the region immediately adjacent to Pennsylvania, known as the Southern Tier (Wilber 2012).

New York's existing regulations were not favorable to shale gas development, but lawmakers quickly passed a critical bill in 2008 that made it easier to issue permits for shale gas wells. The Governor signed the bill into law but ordered the New York Department of Environmental Conservation (DEC) to review the Generic Environmental Impact Statement governing well permitting guidelines. The review was publicly interpreted as a "cautionary yellow light" in the progress toward full-scale shale gas development in New York (Applebome 2008). Observers believed that fracking in New York was inevitable, and that the review—slated to be completed within a year—would not impede development in a serious way (Wilber 2012). These estimates proved wrong, as the anti-fracking movement grew rapidly under the de facto moratorium. Opponents pressured the agency into multiple rounds of review, until, six years later in December 2014, New York banned the use of fracking in the state (Kaplan 2014). These state-level politics provide essential context for the municipal ban movement. The extended environmental review, in particular, created space for the municipal ban movement to emerge.

Between March 2010 and July 2013, 164 towns and cities passed land use ordinances prohibiting fracking within their borders (see Figure 1).

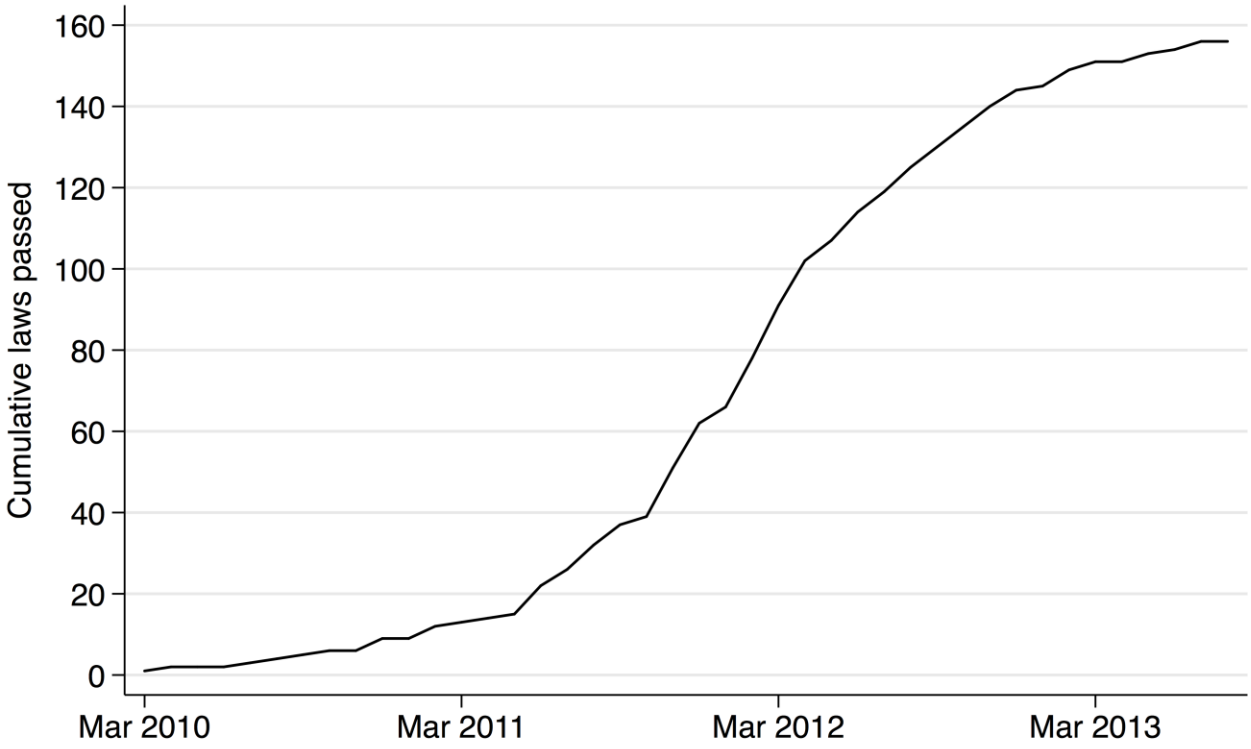


**Figure 1.** Adoption of Municipal Anti-fracking Ordinances in New York State

*Local Politics of Fracking*

Understanding how locally perceived risks and benefits shaped the adoption of anti-fracking land use ordinances requires attention to the geography of shale gas development in New York. Although much of upstate New York lies above the Marcellus Shale, and an even larger area lies atop the fossil-fuel-rich Utica Shale, critical geologic factors constrain potential shale gas development in New York to the Southern Tier region along the border with Pennsylvania

(Engelder 2009; Wilber 2012). Only in this region is the Marcellus Shale deep enough to permit gas development; geologists estimate that the region of productive Utica Shale largely overlaps with that of the Marcellus (Wilber 2012). The gas well permit record provides further support for these estimates of the distribution of development potential in New York. Figure 2 shows the geographic extent of the Marcellus and Utica Shale and the concentration of HVHF well permits in New York State. Each circle represents a filed well application. Consistent with geologists' estimates of the fairway regions, applications are limited to seven counties, mostly along the Pennsylvania border.[3]

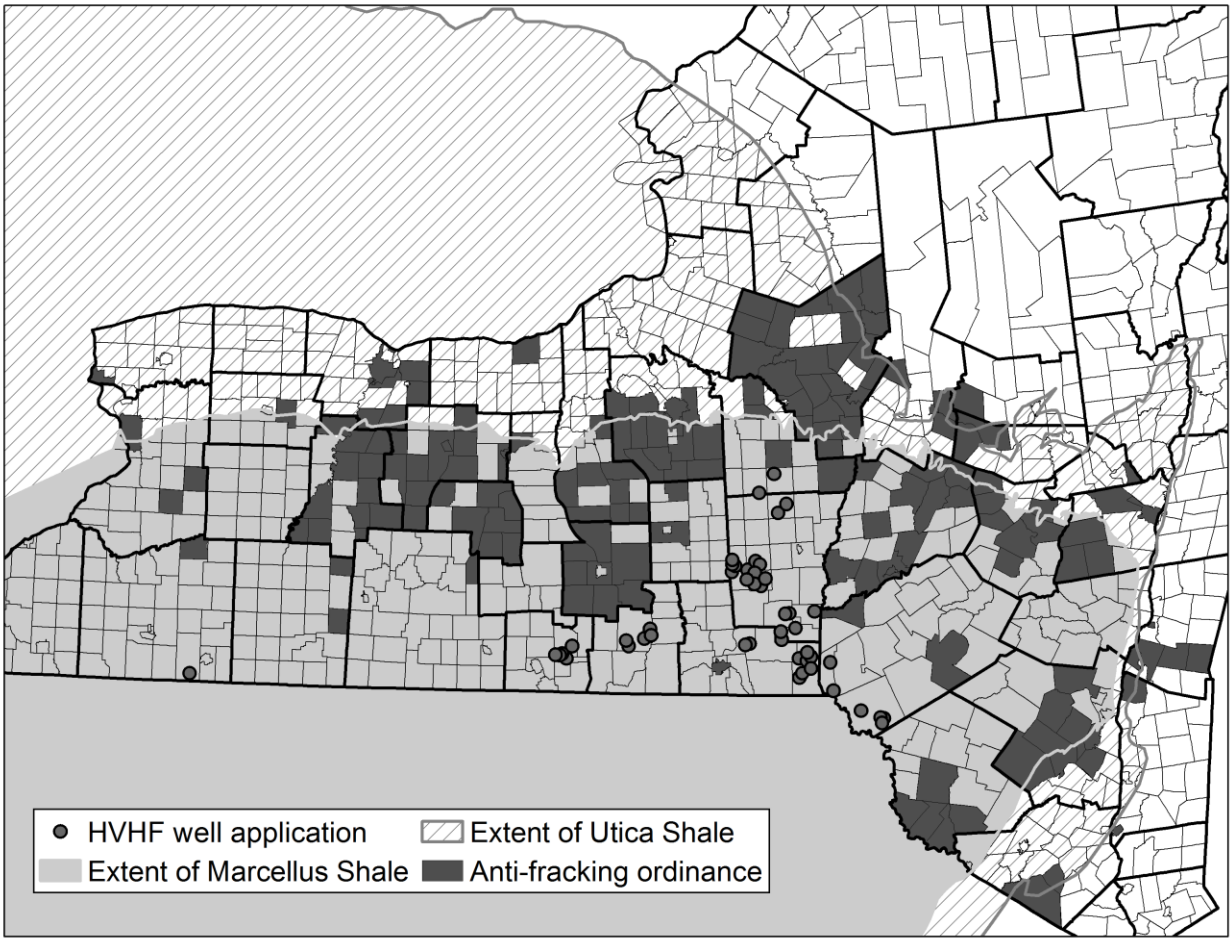


**Figure 2**. Geographic Diffusion of Anti-fracking Ordinances and the Geology of Shale Gas Development in New York State

*Note:* Dots indicate locations of HVHF well applications; dark shading designates towns that passed a local ordinance prohibiting fracking. Counties are marked by thicker black lines; municipalities are the smaller entities with thinner boundaries inside county lines.

*NIMBY opposition*. Fracking is a heavily industrial process. The drilling process itself, lasting about six weeks for a typical well, proceeds 24-hours a day, causing significant noise and light pollution for proximate residents. Among the biggest local concerns is the massive influx of truck traffic, primarily for transporting water to and from well sites. Development also brings an influx of transient workers, which strains local public services and is associated with elevated crime rates (Jacquet 2014). Aside from these observable disturbances, uncertainty about potential health and environmental impacts provide additional motivation for local opposition (Boudet et al. 2014; Wilber 2012). In this way, fracking resembles the siting of projects involving other complex technologies (McAdam and Boudet 2012; Sherman 2011; Walsh 1991).[4]

Disruptions to daily life and health and environmental effects should decrease with distance from proposed well sites, consistent with the idea of NIMBY-style opposition. Note, however, that the geographic scale at which people perceived risk was substantial: the majority of the state's towns lie above at least one of the two targeted shale formations (Figure 2). Although most parts of the shale are not productive, few in the general public were aware of this. Moreover, the shale gas industry would require additional infrastructure to be built for storing and transporting the gas, which would potentially extend into surrounding communities. This leads us to expect that, although the geographic scale at which risks from fracking could be credibly framed was necessarily limited, NIMBY-style opposition likely extended beyond the immediately targeted communities into surrounding towns, especially towns lying on one or both of the shale formations.

*PIMBY support.* Gas development was also framed as having positive economic effects, which served as a basis of local support for fracking. Development may provide a new source of tax revenue for local governments and create new employment opportunities with gas companies and in related industries (Jacquet 2014). Perhaps most importantly, development offers substantial cash transfers in the form of lease and royalty payments to local landowners (Jacquet and Stedman 2011; Jerolmack and Walker 2016).[5] Appeals to economic benefits should especially resonate with residents of the economically depressed upstate New York region where development would concentrate (Wright and Boudet 2012). Indeed, research finds that residents of communities targeted for shale gas development sometimes adopted favorable conceptions of fracking. Pennsylvania residents, especially leaseholders, expressed significant support for the gas industry (Jacquet 2012; see also Jerolmack and Walker 2016; Willits, Luloff, and Theodori 2013).

In New York State, political support for the gas industry also accompanied favorable geologic conditions. Notably, landowner coalitions, which were organized during early stages of the gas boom to collectively bargain for better lease terms with gas companies, emerged as strong supporters of gas development in communities lying above the most favorable regions of the shale (Jacquet and Stedman 2011; Wilber 2012). Signs distributed by landowner coalitions quickly spread along country roads across much of the Southern Tier region, identifying property owners as "Friends of Natural Gas."

These observations lead us to expect that in communities targeted for development, PIMBY supporters of fracking may counter local opposition and decrease a community's likelihood of adopting an anti-fracking ordinance. PIMBY support, however, operates on a different geographic scale than NIMBY opposition. Whereas risk from fracking was perceived

across much of the upstate region, economic benefits of shale gas development could be credibly framed only in communities where the gas industry expressed an interest in leasing acreage. Considering local opposition and support together, anti-fracking ordinances should be most likely to pass in the periphery of a targeted region, where perceptions of threat existed but promises of economic benefits were not credible.

*Politicization of Fracking*

During the period of the municipal ban movement, fracking evolved from an obscure issue concerning land use in rural upstate New York to become a popular and ideologically polarized issue (Mazur 2016). Fracking was slow to gain media and popular attention and initially lacked ideological salience, as two key facts demonstrate. First, the 2008 regulation enabling shale gas development passed both houses of the New York State Legislature with overwhelming bipartisan support and with little notice by the public at large. The *New York Times* reported on the law's passage at the time: "Sometimes big issues coalesce with people barely seeing them" (Applebome 2008). Reflecting the issue's lack of political salience, this was just the third article ever published by the newspaper to mention "fracking" or "hydraulic fracturing." Second, there was no consensus about fracking within the environmental community. Some regional environmental groups pressed New York's governor to slow development (Wilber 2012), but the Sierra Club and other mainstream, national environmental organizations *endorsed* hydraulic fracturing, seeing natural gas as a potential alternative to the carbon-intensive coal industry (Sheppard 2012).

Public debate about fracking was slow to start, but it grew rapidly. As Figure 3 shows, just 22 articles about fracking appeared in the *New York Times* before 2010, whereas nearly 40

articles mentioning “fracking” or “hydraulic fracturing” were being published *every month* in 2012. A measure of Google search volume for the word “fracking” by New Yorkers mirrors the trend in newspaper coverage (bottom panel of Figure 3).

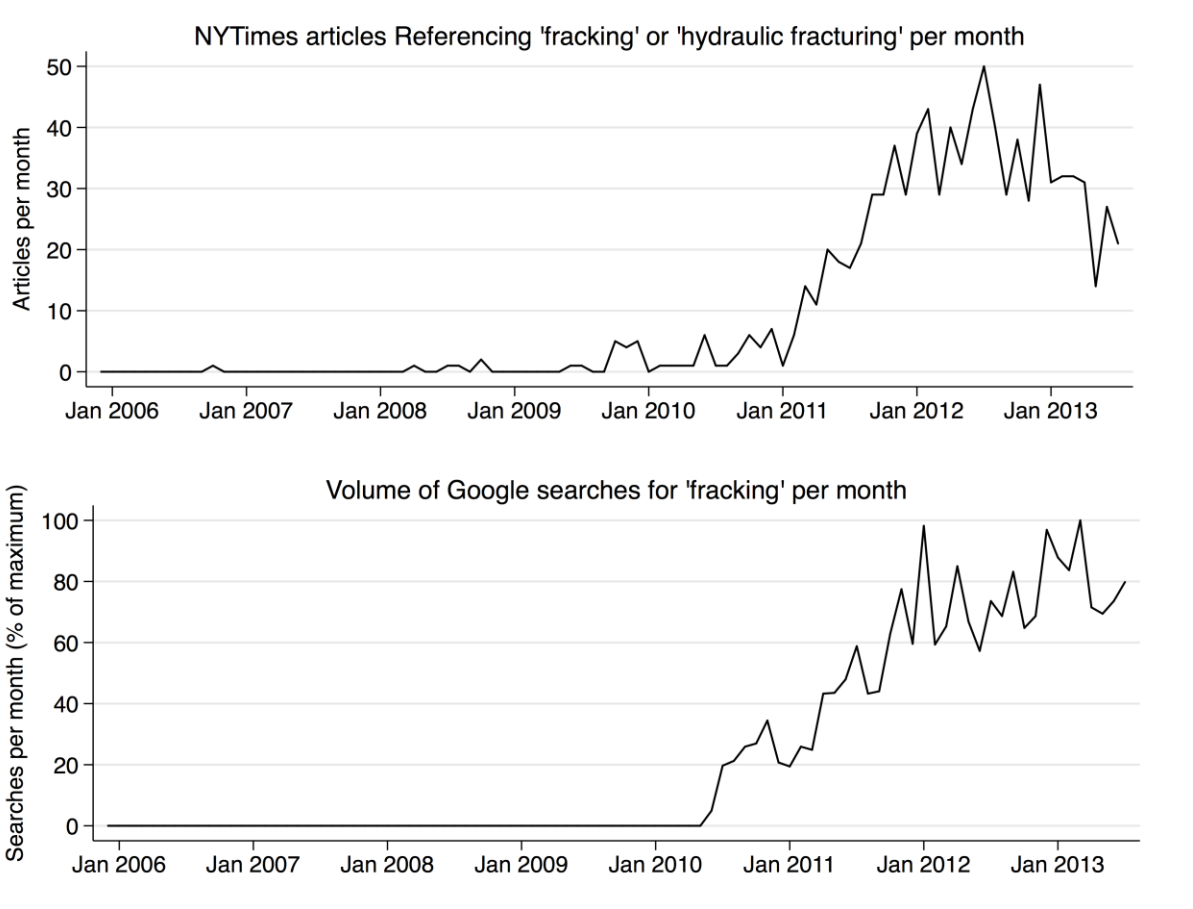


**Figure 3.** Public Attention to Fracking as Measured by Coverage in the *New York Times* and Google Search Volume

*Note:* Top panel displays the distribution of the number of articles published in the *New York Times* that contain the words “fracking” or “hydraulic fracturing” per month. Bottom panel displays the volume of Google searches for the term “fracking” in New York State. The scale of the *Y*-axis is normed by the maximum search volume achieved in the time period.

The biggest environmental argument for developing natural gas—that it was a less carbon-intensive alternative to coal—was being challenged by new research suggesting that the amount of methane that leaks during production may offset the relatively lower carbon dioxide

emissions of gas-powered power plants (Howarth, Ingraffea, and Engelder 2011). Popular films, like the documentary *Gasland* and the fictional Hollywood production *Promised Land*, contributed to the emerging environmentalist opposition to fracking (Vasi et al. 2015). By 2012, the Sierra Club could no longer sustain its endorsement of shale gas if it hoped to retain legitimacy among its base, and it officially came out against hydraulic fracturing (Sheppard 2012).

As more people learned about fracking, they did so in an increasingly politically polarized information environment. In a study that compares attitudes of Pennsylvania residents between 2009 and 2012, Willits and colleagues (2013) identify a rapid learning process. They document increasing polarization on the issue and an increased emphasis on environmental impacts among opponents. Polls conducted after 2012 show a vast partisan divide on attitudes toward fracking, with liberals opposing the technology and conservatives supporting its use (Boudet et al. 2014; Davis and Fisk 2014). These developments signaled a substantial shift in the public debate surrounding fracking during the period of the local ban movement, 2010 to 2013.

I expect that politicization of fracking led to greater mobilization of political partisans. This shift should increase the likelihood of ordinance adoption among communities with large Democratic constituencies, independent of proximity to proposed development.

*Policy Diffusion*

Much of the research on opposition to industrial siting looks for explanatory factors within communities, but I expect that activities in surrounding communities might also influence passage of protective ordinances. Previous research finds evidence for spatial policy diffusion in multiple domains and for different units of analysis (Andrews and Seguin 2015; Vasi and Strang

2009). Collective action spreads geographically (Hedström 1994), but local learning processes also influence decision-makers (Tolbert and Zucker 1983). In the context of municipal fracking bans, interaction between town officials was especially important, because zoning ordinances prohibiting fracking were controversial. Town officials learned about the legal rationale behind the ordinances from officials of neighboring towns and could develop a sense of "safety in numbers," knowing they were not acting alone in the face of lawsuit threats. This is precisely the setting where one would expect endogenous diffusion dynamics.

## DATA AND METHODS

In the main analysis, I examine the adoption of anti-fracking ordinances among communities in New York State. I focus on New York for several reasons. New York had the most extensive town ban campaigns, which permits a quantitative analysis of local opposition. At the same time, focusing on a single state enables a more in-depth analysis characteristic of a case study. My analysis draws on field observations and primary documents and secondary sources related to the fracking debate in New York State. Specifically, I collected and reviewed more than 500 documents (including town board minutes and local newspaper articles), and over the course of three years (2011 to 2013), I attended town board hearings on proposed fracking bans in five communities, and I sat in on nine meetings of anti-fracking organizations and two meetings of organizations that supported fracking. In general, this dual-analytic framework responds to recent calls to make studies of social movements more grounded methodologically (McAdam and Boudet 2012). New York's anti-fracking movement was highly successful, but because my primary outcome of interest is at the community level and includes towns that passed bans as

well as those that did not, the analysis avoids the common criticism that social movement studies select cases on the dependent variable.

*Event History Data*

The population of communities at risk of adopting an anti-fracking law consists of New York's 994 municipalities—932 towns and 62 cities.[6] The event of interest is the passage of a town or city's first zoning ordinance prohibiting fracking, either a ban or a moratorium. During the period of analysis (March 2010 to July 2013), 164 municipalities passed an ordinance.[7] The dependent variable is a municipality's hazard of ordinance adoption—that is, the probability that a particular town in the risk set adopts an ordinance in a particular time period. A town exits the risk set after adopting an ordinance. I used primary and secondary sources to compile data on the adoption of ordinances, referring to lists maintained by two independent organizations—Food and Water Watch, which took an early interest in the local campaign to ban fracking and kept a record of town laws, and Fractracker, which kept close track of New York's local ban movement. For each town or city thus identified, I obtained a copy of the meeting minutes from the session during which the ordinance was passed and/or an article in a newspaper that referenced the day of the law's passage.[8]

The inclusion in my analysis of all New York municipalities, large and small, distinguishes my research design from most recent studies of policy diffusion. Researchers often omit smaller communities from analysis, due to data limitations, and focus instead on larger political units—states, counties, or large cities (e.g., Tolbert and Zucker 1983; Vasi and Strang 2009). Studying small communities is important for several reasons. First, policy change at higher levels of the federal system is often precipitated by struggles at lower rungs of the system

(Andrews and Seguin 2015). Second, exclusion of large amounts of political action that happens in smaller communities may yield biased estimates of diffusion effects. Finally, excluding small, sparsely populated communities is especially problematic in studying the spread of land use policies, because these communities comprise the largest share of the area where industrial projects are sited. According to the 2010 Census, 329 of New York's 994 municipalities had fewer than 2,000 residents, and nearly two-thirds (628) had fewer than 5,000 residents. These sets of municipalities make up 34 and 68 percent of New York's entire land area, respectively. The inclusion of small communities is an important contribution of the present study.

*Independent Variables*

*Proximity to development and the strength of NIMBY and PIMBY constituencies.* Proximity confounds two latent variables: (1) risk from fracking, which motivates NIMBY opposition and (2) potential economic benefits from fracking, which motivate PIMBY support. My proposed explanation suggests an approximately curvilinear relationship between proximity and the probability of passing a ban (Jenkins-Smith et al. 2011). Probability should be lower in communities most proximate to development, due to PIMBY support for fracking, higher as support subsides toward the periphery of a development region, and then lower again in very distant communities that do not perceive any credible risk from fracking. I measure proximity to development as a community's distance to the closest proposed gas well. The gas industry filed 92 HVHF well permit applications in New York State. For each community, I calculated the distance to all proposed well locations and chose the shortest distance. I include a quadratic term to test for the proposed curvilinear relationship (several alternative specifications of distance yield consistent results; see note 14 for details).

Although a curvilinear effect would be consistent with the proposed explanation, proximity alone does not permit us to distinguish between the countervailing effects of the two hypothesized mechanisms: support of fracking from people who view it as a benefit, and opposition from those who emphasize its risks. Thus, to test these proposed mechanisms more directly, I include two measures to capture the perception of threat and the perception of economic interest in development separately. Being located on the targeted shale formations, although not a good predictor of actual shale gas development, contributed to residents' perception of risk. The Marcellus Shale was the primary targeted formation, but the more expansive Utica Shale also featured prominently in debates about fracking. I thus include two dummy variables, indicating a town's location on each formation.

In terms of economic interest, landowner coalitions represent the presence of a critical mass of local residents interested in developing the resource (Jacquet and Stedman 2011). A typical landowner coalition may include hundreds of members representing tens of thousands of acres. I include a dummy variable indicating the presence of a landowner coalition in a county.[9]

*Community political profile.* I measure a community's political profile using precinct-level results of the 2010 New York State gubernatorial election, aggregated to the municipal level.[10] I use the vote share for the Green Party candidate, Howie Hawkins, as a measure of the presence of environmentalists in a community. The Green Party of New York was an early opponent of fracking, endorsing a statewide ban in 2010. Its supporters may have been important in bringing attention to the issue early on. I use the vote share for the Democratic candidate, Andrew Cuomo, as a measure of the size of Democratic Party supporters. To test whether the effects of communities' political profiles changed as the debate over fracking became politicized, I interact both variables with time (see details in the Modeling Strategy section).

*Diffusion.* To model the diffusion process, I specify all municipalities in a town or city's county as its relevant set of reference municipalities. In other words, the diffusion variable is the number of other municipalities in the county that adopted an anti-fracking ordinance prior to the present time period. There are several reasons why towns in the same county should form a particularly strong reference group for one another. First, especially in rural counties, the county seat acts as a commercial and cultural center for county residents. Additionally, informal institutions, like councils of governments, tend to be organized at the county level and provide forums for municipal officials to interact, exchange ideas, and develop cooperative relationships. In robustness analyses, I specified the diffusion variable using spatial proximity with different radii (between 10 and 50 miles) and found consistent results.

*Community Context Variables and Control Variables.* Recent research identifies several community-level variables that condition residents' responses to industrial siting (Wright and Boudet 2012). Specifically, previous research finds that residents of communities with historic experience with an industry tend to have more positive views of it (Molotch et al. 2000; Wright and Boudet 2012), and residents of economically depressed regions and residents in rural areas are more likely to view industrial projects as economic opportunities (Davis and Fisk 2014; Wright and Boudet 2012). I include the unemployment level as a measure of economic hardship. These data come from the 10-year American Community Survey (ACS). More recent estimates would be preferred, but the inclusion of small communities makes data based on such estimates unreliable.[11] I also include a dummy variable designating a town as being located in a rural county in accordance with the USDA's Rural-Urban Continuum Codes (RUCC). Finally, the historical presence of an industry may imprint a community and predispose residents to view it in a positive light (see Wright and Boudet 2012). New York's western upstate region has a rich

history of oil and gas development, with thousands of oil and gas wells developed in New York since the nineteenth century. Using data from New York State's Department of Environmental Conservation (DEC) Oil and Gas database, I identified the location of all historic oil and gas wells drilled in New York State. For each municipality, I calculated the number of wells located within a 10-mile radius of the town. I designated any municipality that had at least 500 historic wells within a 10-mile radius as an oil/gas community.[12]

Additionally, I include two standard variables of local capacity for mobilization (McCarthy and Zald 1977). The first variable is a measure of educational attainment, operationalized as the percent of residents in a community with a bachelor's degree and derived from the 10-year ACS. Second, existing organizations provide useful infrastructure that can be repurposed and mobilized toward a particular goal (McCarthy and Zald 1977). As in other examples of policy change (see, e.g., Vasi and Strang 2009), colleges and universities played an important role in spurring mobilization on the issue of hydraulic fracturing. I obtained data on the location of college and university campuses in New York State from the Integrated Postsecondary Education Data System (IPEDS); the models include a logged number of campuses. Finally, I include logged population size obtained from the 2010 Census.[13] Table 1 presents descriptive statistics and correlations of all variables.

**Table 1.** Summary of (Non-standardized) Variables and Correlations

| Variable | Mean | SD | Min. | Max. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Log population | 8.25 | 1.32 | 3.64 | 15.92 | 1.00 | | | | | | | | | | | | |
| 2. Rural town dummy | .48 | .50 | .00 | 1.00 | –.49 | 1.00 | | | | | | | | | | | |
| 3. Unemployment | 3.57 | 1.50 | .00 | 1.91 | –.06 | .06 | 1.00 | | | | | | | | | | |
| 4. Oil/gas town dummy | .09 | .29 | .00 | 1.00 | –.04 | .19 | –.05 | 1.00 | | | | | | | | | |
| 5. Education (% with bachelor's) | 15.85 | 8.38 | .00 | 53.79 | .43 | –.33 | –.31 | –.07 | 1.00 | | | | | | | | |
| 6. Log number of colleges/universities | .07 | .29 | .00 | 4.50 | .48 | –.15 | .00 | –.02 | .23 | 1.00 | | | | | | | |
| 7. Miles to nearest well | 63.08 | 40.26 | 0.00 | 191.00 | .15 | –.07 | .01 | –.20 | .19 | .09 | 1.00 | | | | | | |
| 8. Democratic vote share | 44.73 | 11.95 | 13.88 | 84.99 | .37 | –.17 | .02 | –.46 | .35 | .28 | .42 | 1.00 | | | | | |
| 9. Green Party vote share | 1.64 | 1.05 | .00 | 7.33 | –.10 | –.04 | –.04 | –.10 | .04 | –.02 | –.21 | .10 | 1.00 | | | | |
| 10. Number of prior ordinances in county | .93 | 2.37 | .00 | 21.00 | .04 | –.08 | –.02 | –.04 | .02 | –.04 | –.19 | –.01 | .18 | 1.00 | | | |
| 11. On Utica Shale dummy | .27 | .45 | .00 | 1.00 | .25 | –.39 | .04 | –.18 | –.01 | .00 | .08 | .06 | .08 | .07 | 1.00 | | |
| 12. On Marcellus Shale dummy | .45 | .50 | .00 | 1.00 | –.27 | .32 | –.02 | .33 | –.21 | –.11 | –.71 | –.41 | .08 | .12 | –.56 | 1.00 | |
| 13. Landowner coalition dummy | .29 | .46 | .00 | 1.00 | –.20 | .29 | .07 | .22 | –.22 | –.06 | –.64 | –.34 | .06 | .06 | –.34 | .66 | 1.00 |

*Modeling Strategy*

I analyze the adoption of anti-fracking ordinances in an event history framework (Allison 2014). The outcome variable is a town's hazard of adopting an ordinance. The event history framework is particularly suitable for modeling diffusion processes (Strang and Tuma 1993). Equation 1 specifies the theorized diffusion process,

$$h_n(t) = h_0(\mathrm{t}) \exp\left( \beta_1 X_n + \sum_{s \in S(t)} \beta_2 Z_{ns} \right) \qquad (1)$$

where $h_0(\mathrm{t})$ represents the baseline hazard rate at time *t*, *n* specifies a focal community that has not passed an ordinance by time *t*, and *S*(*t*) represents the set of communities that passed an ordinance prior to time *t*. Community-level covariates are entered into vector $X_n$. In the second term, $Z_{ns}$ equals 1 if community *s* is in community *n*'s reference group (in our case, in the same county), otherwise $Z_{ns}$ equals 0. Therefore, $\beta_2$ captures the effect that the prior passage of each additional ordinance within a county has on the focal community's hazard of adoption.

I use the Cox proportional hazards specification to estimate the model. The Cox model requires fewer assumptions than parametric specifications, because it does not restrict the baseline hazard to a particular functional form. However, because the Cox model assumes that effects are invariant over time (i.e., the estimated coefficients represent the average effect of a variable over the entire analysis period), the simple model in Equation 1 cannot be used to test the hypothesis that the effect of a community's political profile changes over the course of the adoption period. A standard modification that permits estimation of time-dependent effects is to add an interaction term between a variable of interest and (some function of) time (Allison

2014). The final model, including diffusion and time variant effects for ideological variables is represented as follows:

$$h_n(t) = h_0(\mathrm{t}) \exp\left(\beta_1 X_n + \sum_{s \in S(t)} \beta_2 Z_{ns} + \beta_3 V_n + \beta_4 f(t_n) V_n\right) \quad (2)$$

Equation 2 is identical to Equation 1, except we distinguish a vector of covariates, $V_n$, which we interact with a function of time, $f(t_n)$. Therefore, the effect of $V_n$ on the hazard at time *t* is equal to $\beta_3 + \beta_4 f(t_n)$, which reduces to $\beta_3$ when $f(t_n) = 0$. In our case, vector $V_n$ includes two variables, vote shares for Democratic and Green Party candidates, and I adopt a simple linear function of time. I tested several alternative specifications of time, which yield consistent results (see note 16 for details).

**RESULTS**

Figure 2 displays the distribution of anti-fracking ordinances in New York State. Towns and cities that passed a zoning ordinance are shaded dark gray. The mismatch between likely location of gas development and the distribution of protective zoning ordinances is striking. Municipalities that passed protective bans and moratoria are concentrated in a belt surrounding the primary development region, with few ordinances passed in the targeted zone near the proposed wells. Some bans are in towns overlying parts of the Marcellus or Utica Shale formations that do not contain recoverable natural gas, and a few are removed from the shale entirely.

**Table 2.** Partial Likelihood Estimates of the Passage of Anti-Fracking Ordinances among New York Municipalities, March 2010 to July 2013

| Variable | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Log population | –.254* | –.386** | –.391** | –.317** |
| | (.114) | (.117) | (.117) | (.122) |
| Rural (D) | –.831** | –.646** | –.645** | –.440 |
| | (.208) | (.213) | (.214) | (.228) |
| Unemployment | –.073 | –.066 | –.078 | –.006 |
| | –.093 | –.092 | –.092 | (.090) |
| Oil/gas town (D) | –1.944** | –1.611* | –1.607* | –1.548* |
| | (.738) | (.742) | (.742) | (.741) |
| Education | .342** | .365** | .376** | .330** |
| | (.086) | (.087) | (.086) | (.089) |
| Log number of colleges/universities | .234** | .251** | .241** | .240** |
| | (.078) | (.077) | (.078) | (.070) |
| Miles to nearest well | .121** | .105** | .106** | |
| | (.018) | (.018) | (.018) | |
| Miles to nearest well squared | –.00156** | –.00131** | –.00133** | |
| | (.000199) | (.000197) | (.000197) | |
| On Utica Shale (D) | | | | 1.564** |
| | | | | (.400) |
| On Marcellus Shale (D) | | | | 2.602** |
| | | | | (.386) |
| Landowner coalition (D) | | | | –.731** |
| | | | | (.243) |
| Democratic vote share | .340** | .434** | –.196 | –.251 |
| | (.119) | (.123) | (.315) | (.305) |
| Green Party vote share | .0694 | .0268 | .532** | .540** |
| | (.066) | (.066) | (.171) | (.169) |
| Number of prior ordinances in county | | .116** | .117** | .153** |
| | | (.017) | (.017) | (.017) |
| Democratic vote share × month | | | .0271* | .0234* |
| | | | (.012) | (.012) |
| Green Party vote share × month | | | –.022** | –.0203** |
| | | | (.007) | (.007) |
| Likelihood ratio | 260.62 | 301.05 | 312.66 | 274.20 |
| *df* | 10 | 11 | 13 | 14 |

*Note: N* = 117,214. Standard errors are in parentheses. All variables are standardized and centered at the mean, except distance to well, prior number of adoptions, and all dummy variables.

*$p < .05$; **$p < .01$ (two-tailed test).

Table 2 presents the results of four event history models. The first includes just town-level covariates and does not interact vote shares with time. The second model adds the spatial diffusion component. The third, full model, includes diffusion and time-dependent effects of ideology. The fourth model retains all the variables from the full model, but replaces the distance variables with separate proxies for perception of risk, on the one hand, and concentration of potential economic benefits, on the other. All variables in the models, except dummy variables and miles to closest proposed well, are standardized and mean-centered for ease of interpretation.

Before turning to the primary effects of interest, I report three results that provide additional support for prior research. First, communities with more resources were more likely to mobilize against fracking. Both education and the presence of university campuses are associated with an increased hazard of ordinance adoption. Second, the results support recent research that identifies community context as important for developing motivation for mobilization (Wright and Boudet 2012). Effects of being in a rural county and having a history of oil and gas development are consistently negative, supporting the idea that residents in these communities were more likely to view gas development as an economic opportunity rather than a threat. Other than the effect of unemployment, which is not a significant predictor in any of the models, the community context effects remain statistically significant as additional variables are added to the model. Third, there is strong evidence for spatial diffusion of municipal ordinances. Adding the diffusion variable dramatically increases the model fit (Model 2 versus Model 1). In the full model (Model 3), for every additional town in the county that passes an ordinance, the remaining towns' hazard of adoption increases by 12 percent. Successful anti-fracking mobilization spilled from one community to its neighbors, particularly within a county. I now turn to the primary effects of interest.

*Proximity effects*. Statistically significant coefficients on both linear and quadratic terms indicate a curvilinear relationship between distance to a proposed well and the probability of passing an anti-fracking ordinance. Figure 4 plots the relative hazard of passing a protective ordinance against distance to the closest well from the full model (Model 3). Compared to towns nearest to proposed well sites, the adoption hazard increases with distance from the site, reaching its highest value about 40 miles away, but remaining higher for towns at a distance of up to 80 miles away.

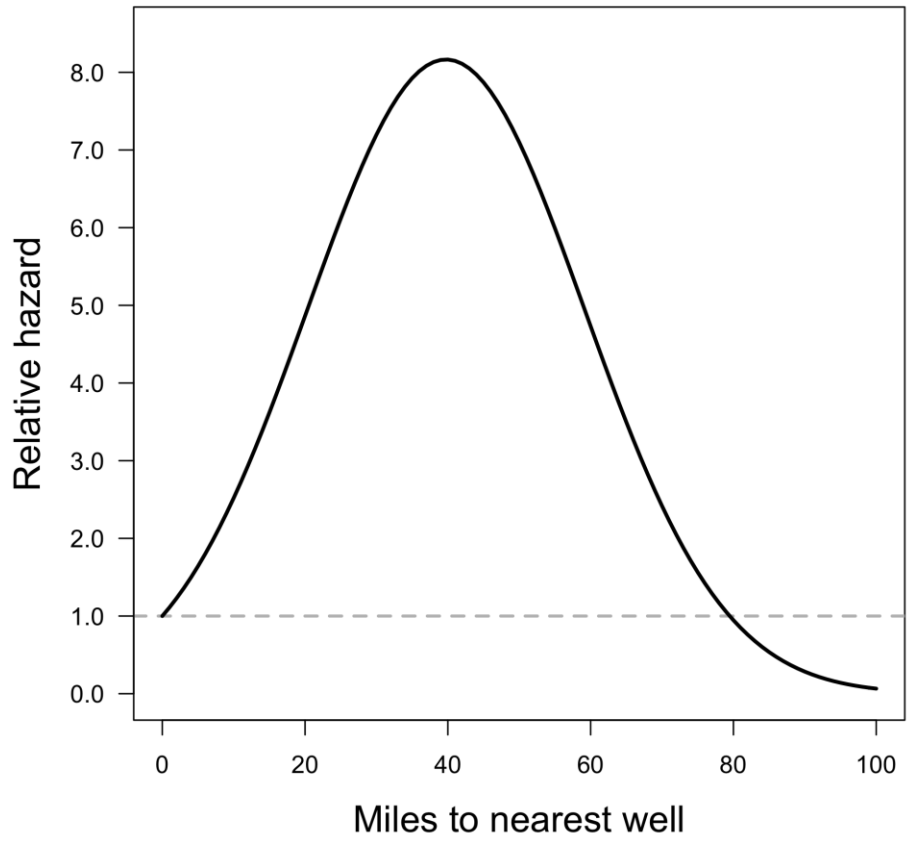


**Figure 4.** Effect of Distance to Nearest Proposed Well on Hazard of Passing an Anti-fracking Ordinance (Model 3)

First, it is extremely difficult to pass an ordinance in communities closest to development. For instance, of the 65 communities within a 10-mile radius of a proposed well, only three (4.6 percent) have passed an anti-fracking ordinance. In contrast, 16.5 percent of *all* New York communities have passed an ordinance. Second, despite ordinance adoption in places unlikely to see shale development, results suggest that distance does impose some restrictions on successful mobilization against fracking. The hazard of adoption declines beyond about 40 miles, and communities farther than 80 miles are less likely to pass bans than are the most proximate communities. Nonetheless, the results suggest that in the case of opposition to fracking, the size of the relevant "backyard" is vast. For all but the most remote communities, the hazard of adopting an ordinance is higher than in towns that actually have proposed wells within their borders. Nine towns that did not lie on either the Marcellus or Utica Shale passed anti-fracking ordinances. However, as Figure 4 indicates, bans were most likely to pass in a sweet spot region that was neither too close nor too far from development.[14]

The models that use the proximity variable, however, do not directly test the latent processes that are expected to give rise to this geographic pattern. Model 4 attempts to distinguish between the negative effects of landowner (PIMBY) support, on the one hand, and positive effects of local (NIMBY) opposition, on the other hand. The results show, first, that communities lying on top of shale formations were much more likely to pass bans. Compared to communities not lying on any shale, municipalities lying atop both the Marcellus Shale and the Utica Shale are 12.5 times more likely to pass an anti-fracking ordinance, and municipalities that lie above just the Utica Shale are 3.8 times more likely to pass an ordinance. The presence of a landowner coalition, on the other hand, is associated with more than a two-fold decrease in a municipality's probability of passing an ordinance. Together, these findings support the idea that

the geographic sweet spot for passing anti-fracking ordinances emerged from the countervailing effects of landowner support for the industry in favorable shale regions, and a relatively diffuse perception of threat that motivated residents in surrounding communities to mobilize against fracking.

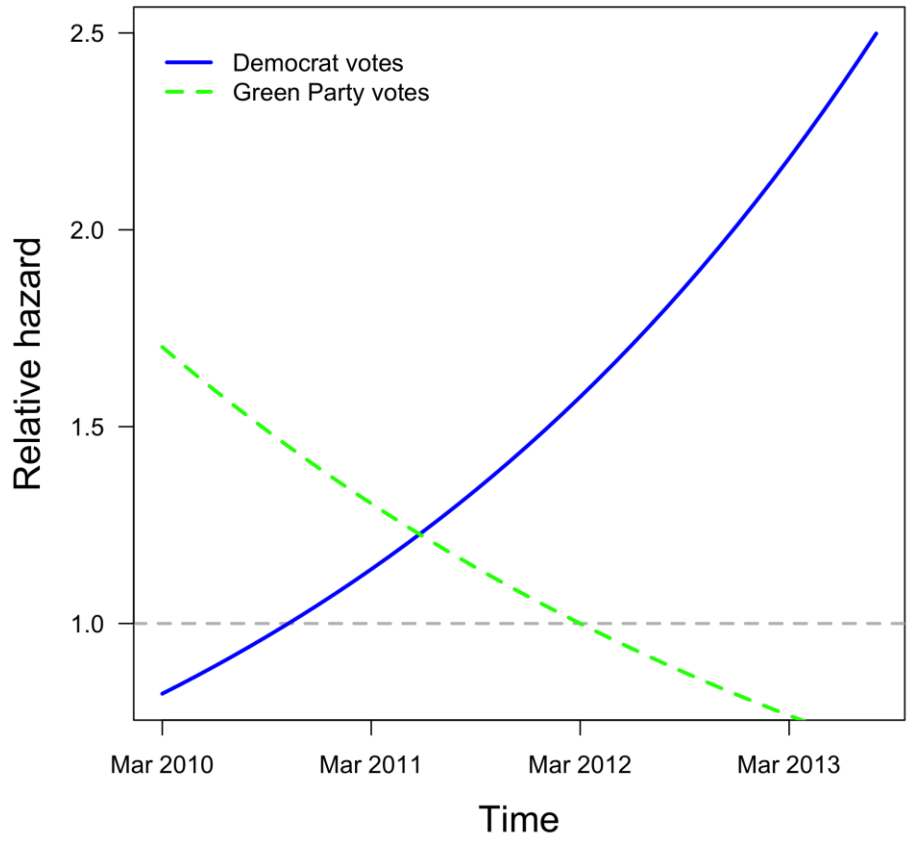


**Figure 5.** Changing Effect of Vote Share on Hazard of Passing an Anti-fracking Ordinance (Model 3)

*Politicization and the changing effect of a community's political profile*. The distribution of local impacts across communities (i.e., potential risks and benefits) shaped the pattern of ban adoption, but my results suggest that residents' political orientation also influenced the strength of opposition. In Models 1 and 2, a greater share of votes for the Democratic candidate increases

the hazard of adopting an anti-fracking ordinance. Results from these models show no significant effect of the Green Party vote. The more substantial and original findings come from models that consider how the effects of vote share change as the national debate over fracking intensifies (Model 3 and 4). The effect of a community's political composition is not constant over time.[15] Figure 5 presents the estimated trends over time in the relative hazards associated with a one standard deviation change in the two vote share variables. Green Party vote share has a large and positive effect on the adoption of an anti-fracking ordinance, but the effect is limited to the early part of the episode. In March 2010, a standard deviation increase in the Green Party vote share (1.05 percent) corresponded to a 70 percent increase in the hazard of adoption. The effect decreased and was not statistically distinguishable from zero within the first year of the analysis period. This result is consistent with literature on policy diffusion, which finds that in the earliest adoption stages, the presence of strong advocates is essential (e.g., Tolbert and Zucker 1983).

The effect of Democratic vote share, by contrast, increased dramatically over the course of the adoption period. At the beginning, communities with more Democratic supporters were not more likely to pass anti-fracking ordinances. But the effect of Democratic vote share increased rapidly as the fracking debate unfolded (Figure 5). By the end of the study period (July 2013), a one standard deviation difference in Democratic vote share (11.78 percent) corresponds with an impressive 143 percent increase in the probability of adopting an anti-fracking ordinance. These results support the idea that composition of the local anti-fracking movement changed over time. Aside from the role that Green Party supporters played in bringing attention to the issue in 2010, early opposition to fracking appears to have been based on local concerns, not partisan identities. As the debate surrounding fracking politicized, however, opponents of

fracking found allies among Democrats. This shift corresponds with the acceleration in the diffusion of anti-fracking ordinances observed in Figure 1.[16]

A complementary interpretation of the increasing effect of Democratic vote share for ordinance adoption is that Republican-leaning communities became less likely to ban fracking over time. Due to multicollinearity, it is not possible to distinguish these effects statistically. A model that specifies Republican vote share instead of Democratic vote share yields results symmetrical to the ones presented in Table 2. Republican vote share has no effect on adopting an ordinance at the beginning of the episode, but a standard deviation increase in Republican vote share predicts a 64 percent decrease in the probability of adoption by the end of the analysis period (see Table S4 in the supplementary materials for results of models using Republican vote share).

What effect did the mobilization of political partisans have on the geographic distribution of ban adoptions? If, as I argued, political partisans mobilized on the basis of politicized rather than local conceptions of fracking and its impacts, the distribution of "objective" risks and benefits should have less influence on their mobilization. Communities with large Democratic constituencies should thus be more likely to pass bans outside the geographic sweet spot identified earlier. In distant communities, where industry poses little or no credible threat to residents, partisan mobilization may still provide an impetus for taking symbolic action against fracking. And in proximate communities, sufficient mobilization of partisans may tip the balance in favor of fracking opponents.

To test this idea, I examine the dispersion of town bans around the sweet spot for communities that have different political profiles. Figure 6 presents the geographic distribution of ordinance adoption over time. The scatterplot shows that, as fracking gained broad media

attention, the geographic range of ordinance adoption expanded in both directions, but Democratic-leaning communities (circles in Figure 6; defined as having over 50.9 percent [mean plus .5 SDs] Democratic vote share) are overrepresented among the outliers. For simplicity, I split the time period in two. In the first half, ending in November 2011, the standard deviations of proximity to a proposed well were not significantly different between Democratic-leaning communities and other communities that passed bans (SD = 12.2 and SD = 12.1 miles for Democratic and other communities, respectively). In the second half, however, bans passed by Democratic-leaning communities were significantly more dispersed around the sweet spot than were bans passed by other communities (SD = 23.0 and SD = 15.7 miles for Democratic and other communities, respectively).[17] The four closest and seven farthest bans were passed by communities where voters gave absolute majorities to the Democratic candidate.

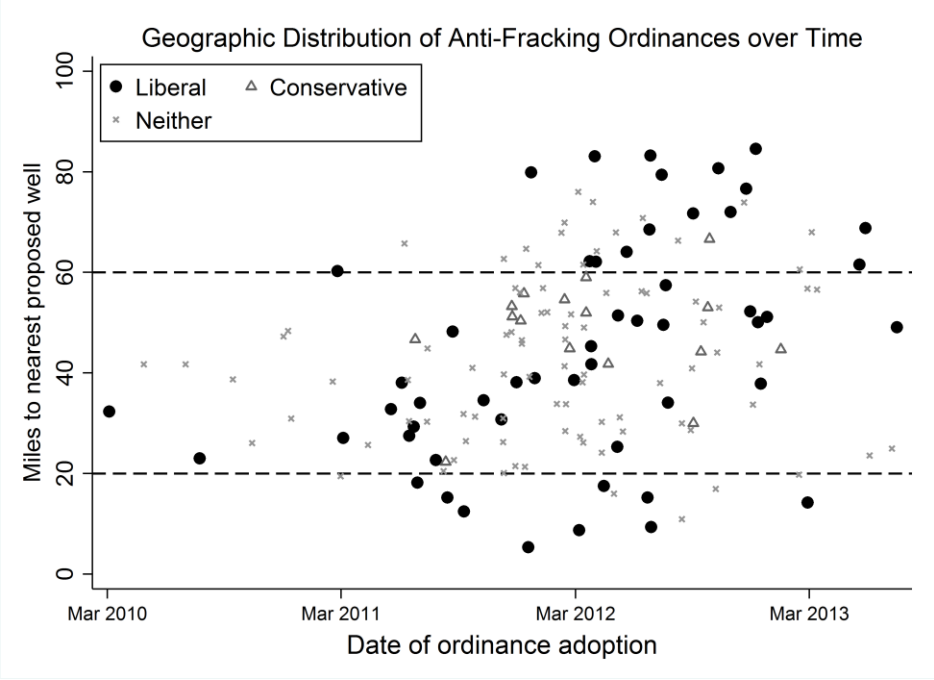


**Figure 6.** Geographic Distribution of Towns That Passed an Anti-fracking Ordinance over Time
*Note:* Circles indicate communities with over 50.9 percent Democratic vote share (mean plus .5 SDs of variable). Triangles indicate communities with over 53.7 percent Republican vote share (mean plus .5 SDs of variable). Other towns that passed bans are represented as x's.

Mobilization of partisans thus played a key role in the spread of anti-fracking laws. The "not in anyone's backyard" attitude of partisan opponents helps explain the increased geographic dispersion of town bans. The NIABY view strengthened the opposition in proximate communities, and even more strikingly, it enabled the town ban movement to spread to ever more distant communities—communities that would likely not have perceived a stake in the debate over fracking had the issue not become politicized.

*Supplementary Analyses*

Consistent with the proposed explanation, event history analyses show that ordinances passed in communities where one would expect little support for fracking but significant local opposition—due either to perceived risk or partisan mobilization. However, because the dependent variable in the analyses is adoption of an ordinance (a successful outcome of anti-fracking mobilization), the results cannot distinguish between cases where local opposition mobilized only to be thwarted by counter-mobilization from supporters, and cases where mobilization against fracking never emerged. This distinction is especially important in the region targeted for development, because it implies different interpretations of my results. If local decisions in targeted regions were highly contentious, residents likely mobilized based on competing local conceptions of shale gas development, and geographically concentrated support for development was likely formidable. The alternative, that opposition to fracking never emerged in targeted regions, would suggest that risks were either not perceived or not acted upon.

To rule out this alternative, I examined the emergence of town ban movements, including in towns that ultimately failed to adopt an ordinance. Fractracker kept a record of towns that had

an organized movement for a fracking ban, based on whether local residents had actively lobbied the town board for a local ordinance. I used this information to create an indicator variable for a ban movement in a town. As of July 2013, Fractracker documented movements for a ban in 245 New York communities, of which 81 failed to pass an ordinance.

Where did movements emerge but fail to achieve a local ban? Table 3 presents results from logistic regression models predicting a ban movement. Model 1 includes a linear spline with two knots, at 40.6 miles and 72.7 miles, for the proximity variable. These knots are evenly spaced by percentile (33.3 and 66.6 percent of the proximity variable), and the first knot at 40.6 miles represents approximately the middle of the sweet spot for passing an ordinance. If mobilization was equally likely in the targeted area as in the sweet spot, we should observe a flat slope before the first knot.[18] Results confirm that there is no effect of distance to the well on the probability of movement emergence until the first knot at 40.6 miles. The probability of movement emergence then decreases with distance, as indicated by significant negative coefficients on the second and third spline variables. Thus, communities within a 40-mile radius of a proposed well were equally likely to develop movements against fracking (conditional on the other variables), but the more proximate of these were much less likely to succeed. Model 2 replaces the proximity variables with dummies for location on the Marcellus and Utica shale formations and a dummy for the presence of a landowner coalition. Results from this model show that the probability of movement emergence was much higher in communities lying atop one or both shale formations. However, in contrast to models predicting adoption of laws, presence of landowner coalitions did *not* have a significant deterrent effect on movement emergence. In other words, movements emerged but were defeated.

**Table 3.** Logistic Regression Models of Movement toward Anti-Fracking Ordinances among New York Municipalities

| Variable | Model 1 | Model 2 |
|---|---|---|
| Log population | –.285* | –.161 |
| | (.132) | (.130) |
| Rural (D) | –.896** | –.980** |
| | (.204) | (.219) |
| Unemployment | –.0166 | .00368 |
| | (.0929) | (.0923) |
| Oil/gas town (D) | –2.650** | –2.786** |
| | (.769) | (.753) |
| Education | .383** | .251* |
| | (.112) | (.108) |
| Log number of colleges/universities | .188 | .107 |
| | (.105) | (.0965) |
| Miles to nearest well < 40.6 mi | .00307 | |
| | (.00874) | |
| Miles to nearest well 40.6 mi to 72.7 mi | –.0439** | |
| | –.0107 | |
| Miles to nearest well > 72.7 mi | –.161** | |
| | –.035 | |
| On Utica Shale (D) | | 1.417** |
| | | (.347) |
| On Marcellus Shale (D) | | 3.169** |
| | | (.346) |
| Landowner coalition (D) | | –.199 |
| | | (.231) |
| Democratic vote share | .423** | .323* |
| | (.138) | (.129) |
| Green Party vote share | .175* | .322** |
| | (.0844) | (.0852) |
| Constant | .195 | –2.732** |
| | (.289) | (.312) |
| Likelihood ratio | 309.70 | 263.74 |

*Note:* $N = 994$. Standard errors are in parentheses. All variables are standardized and centered at the mean, except the distance to well spline variables and all dummy variables. Coefficients for spline variables should be interpreted as marginal but cumulative.
*$p < .05$; **$p < .01$ (two-tailed test).

Examining the other predictors of movement emergence, we find, not surprisingly, that many of the factors important for movement success predict movement emergence. Democratic vote share and Green Party vote share predict the emergence of a movement, and community

context (aside from unemployment) and organizational capacity variables are also significant and in the expected direction.

Model results suggest that, in regions closest to proposed wells, anti-fracking mobilization was met with countermobilization by supporters of shale gas development. To assess this contentiousness directly, I examined the roll call votes of town boards that passed anti-fracking laws. Drawing on public documents and newspaper articles about each town that adopted an ordinance, I obtained a record of the roll call vote on the law for 137 of the 164 communities. As expected, communities closer to proposed wells had much higher incidence of contentious town board votes. Of the 12 communities that passed ordinances within 20 miles of a proposed well (and for which roll call data are available), seven included dissenting town board members (58 percent). By contrast, 85 percent of all ordinances were adopted with unanimous town board support.

But what was the nature of local support for fracking in communities targeted for development? In lobbying in favor of shale gas development, landowner coalitions purported to represent the interests of a broad segment of town residents, but classic accounts suggest that development is endorsed by business and political elites. Elites are positioned to capture a larger share of the economic benefits from development and can also better protect themselves and their property from potential adverse impacts (Gaventa 1980). Resolving this issue is beyond the scope of this study, but I offer some preliminary evidence from a community that had over 40 percent of its land under gas company lease—among communities that passed a ban, this town was one of the most proximate to proposed development (15 miles to the nearest well).[19]

Town board meetings were contentious affairs in this community. Over the course of four months, the town held four public hearings on the proposed local ban, and 95 residents spoke at

least once. Among those, 21 spoke in favor of fracking (and against the proposed ban). Considering that a typical town board hearing draws only a few public comments, this is evidence of a significant level of mobilization. One difference is clear: supporters of fracking tended to be large landowners. In comparison to the median fracking opponent who owned just 2.6 acres of land, the median supporter owned 86.8 acres.[20] This provides some evidence that economic interests were an important source of motivation for supporters of fracking.

However, despite the large number of acres that supporters owned, this should not be taken as clear evidence that fracking supporters were community elites. In the rural economy of upstate New York, many large landowners better fit the profile of "land-rich but cash poor." So these results may also reflect findings from previous studies (e.g., Wright and Boudet 2012) that experience of economic hardship leads residents to emphasize economic benefits over potential costs of risky projects. Nonetheless, data from this heavily leased community show that support for fracking had a substantial base among local residents, and large landowners were overrepresented among supporters.

## DISCUSSION AND CONCLUSIONS

The municipal anti-fracking movement provides an ideal opportunity to examine why some communities prohibit industrial land uses and others do not. Results from event history analyses of anti-fracking ordinance adoption in New York State demonstrate the importance of delineating alternative bases of opposition and support for industrial projects. People mobilize for different reasons, based on multiple conceptions of the risks *and rewards* of industrial projects. Explaining local policy change requires attention to the distribution of objective risks

and benefits, but also to the nature and scale of politicized debates surrounding the proposed industry.

In the context of the local opposition to fracking in New York, a framework that incorporates risks and rewards as well as politicization permits us to explain a key empirical puzzle: communities that faced the greatest likelihood of seeing shale gas development were unlikely to pass restrictive ordinances, whereas communities on the periphery of development regions were much more successful at banning the industry. Previous research has paid little attention to local support for industrial projects, but I find that support for gas development played a critical role in preventing communities in the targeted region from passing anti-fracking ordinances. What some residents viewed as a locally unwanted land use (LULU), others saw as an economic opportunity (see also Jerolmack and Walker 2016; Wright and Boudet 2012). My results offer several specific insights into the conditions under which a positive conception of fracking prevailed. First, the results support recent findings that elements of local context can lead residents to emphasize economic benefits of proposed industrial projects (e.g., Wright and Boudet 2012). Particular to fracking, a rural economy and historic experience with the oil and gas industry decreased the chances that a community would mobilize for and pass a ban. Second, support for fracking was motivated by a material interest in shale gas development, and thus was strongest in communities where the prospects for development were most favorable. Evidence based on individual-level data from one community further suggests that support concentrated among large landowners who stood to gain financially from leasing their land.

My finding about the emergence of a sweet spot for ordinance adoption on the periphery of the development region reinforces recent calls for greater attention to spatial scale for understanding social processes (Andrews and Seguin 2015; Downey 2006). The sweet spot

reflected the divergent geographic scales at which risks and economic benefits of shale gas development could be credibly framed. The inherently regional nature of shale gas development provided a diffuse geographic basis for perceiving risks, but the scale at which risk can be credibly framed may be smaller in other cases (see, e.g., Gravelle and Lachapelle 2015). In general, different distributions of perceived risks and rewards would lead to different spatial patterns of movement emergence and success.

My findings also contribute to recent scholarly debates about the impact of politicized discourse and ideological polarization on contentious politics. Challenging the view that residents put aside their ideological differences in the face of a local industrial threat, my results suggest that partisanship was an essential lens that colored residents' perceptions and contributed to local land use decisions. By leveraging the temporal variation in politicized public debate about fracking, I identify a shift over time toward Democratic partisans as a major basis of opposition to fracking. Reflecting a "not in anyone's backyard"-style of mobilization by Democratic partisans, majority-Democrat communities outside the geographic sweet spot—including some communities that did not lie on either of the targeted shale formations—became more likely to pass anti-fracking ordinances. The highly politicized debate about fracking created an environment where the composition of residents' political orientations emerged as a key factor driving local land use decisions. The state-level ban on fracking recently adopted by Vermont can also be interpreted in this light. Vermont holds no unconventional oil or gas reserves, but, as one of the most liberal states in the country, became the first state to ban the practice—a move that was entirely symbolic.

Whereas my focus has been primarily on the positive effect that the mobilization of Democratic partisans had on ordinance adoption, the increasing negative effect of Republican

vote share provides a complementary interpretation. The Town of Covert, a rural community on the periphery of the targeted development region, offers a vivid illustration of the salience of partisan identities in local debates over fracking. In Covert, supporters of shale gas development sent postcards to all town residents that warned, "Liberals are coming to Covert!" The postcards included politically laden images of peace signs and a flower-patterned 1960s Volkswagen Beetle. The campaign urged conservative residents to reject anti-fracking candidates for the town board by suggesting that the fracking ban movement represents the extreme political left.

Several limitations in this study suggest important directions for future research. First, I do not directly measure the different conceptions of fracking behind the alternative bases of opposition and support. Instead, I rely on the variation of underlying risks and benefits across space and the variation in public discourse about fracking over time to argue that different contexts were more or less amenable to particular conceptions. Different conceptions, however, should be observable directly in how residents construct the issue, and future research should seek to measure how such constructions vary across and within communities. Ethnographic approaches, in particular, would help unpack how divergent assessments of the industry emerge (e.g., Auyero and Swistun 2008; Jerolmack and Walker 2016). Additionally, research that elicits open-ended responses (e.g., Boudet et al. 2014) could complement common survey approaches to uncover important heterogeneity in respondents' conceptions of an industry.

Relatedly, the current study documents the increasing salience of political identities in local contests over shale gas development, but it does not address *why* popular positions toward the industry became polarized. Previous work suggests some potential explanations. One line of research finds that positions on a controversial issue can become entrenched along partisan lines when intense debates about the issue expose local political divisions (Baldassarri and Bearman

2007; McVeigh, Cunningham, and Farrell 2014). These locally salient divisions then come to represent the broader partisan divide that people perceive. Other recent research suggests that framing efforts by political elites encourage polarization on contested political issues (Farrell 2015; Walker 2014). Future research might examine how the interaction of these two factors contributed to the partisan polarization surrounding fracking, as well as the long-term effects it might have on partisan politics within communities where the battle lines were drawn most starkly. In general, the politically polarized climate in the United States calls for greater attention to how mobilization of partisan identities affects movements' abilities to build effective coalitions and contribute to policy change (see Heaney and Rojas 2015).

Finally, the current study does not directly examine the mobilizing structures of fracking opponents and supporters. The results do suggest that landowner coalitions were critical to organizing support for gas development. However, to the extent that NIMBY and ideological opponents formed alternative bases of opposition, we might expect that they learned about fracking and mobilized through different organizations and networks (Gould 1995). Recent research suggests that partisans are especially amenable to "supply side" grassroots mobilization, where the supply is a pool of ideologically committed activists who have a history of participation in grassroots campaigns (Brady, Schlozman, and Verba 1999; Walker 2014). This work also identifies the role of multi-issue progressive organizations in targeting and mobilizing these activists (Heaney and Rojas 2015; Karpf 2012). It seems likely that the increased engagement of such organizations may account for the increased role of partisanship. Alongside small neighborhood associations of "concerned residents," the list of organizational members in the umbrella group "New Yorkers against Fracking" includes organizations previously identified by Heaney and Rojas (2015) as key for mobilizing political partisans in the anti-war movement

(e.g., MoveOn.org). It remains an open question, however, whether these organizations disseminated and reinforced alternative conceptions of fracking and what role they played in mobilizing participation across different communities.

**APPENDIX**

*Part A.*

**Table A1.** Test of Proportional Hazards Assumption

| Variable | ρ | Prob > χ2 |
|---|---|---|
| Log population | –.081 | .368 |
| Rural (D) | .032 | .662 |
| Unemployment | .062 | .425 |
| Oil/gas town (D) | .038 | .639 |
| Education | –.056 | .512 |
| Log number of colleges/universities | –.047 | .539 |
| Miles to nearest well | –.072 | .444 |
| Miles to nearest well squared | .139 | .145 |
| Democratic vote share | .183 | .029 |
| Green Party vote share | –.117 | .121 |
| Number of prior ordinances in county | –.133 | .162 |
| | χ2 | Prob > χ2 |
| Global test | 28.340 | .003 |

*Part B. Data Sources for Community Case Study*

Data on public participation in town board hearings came from copies of the official town board minutes book, which I obtained in April 2013 by filing a Freedom of Information Law (FOIL) request. The town board held four official public hearings about fracking. From the minutes, I identified 95 unique speakers and their addresses. I coded each speaker's comment as either for or against the proposal to ban fracking in the town. Of the 95 comments, all but four included a clear statement in favor or in opposition of the ban, leaving 21 fracking supporters and 70 opponents.

Using the speakers' names and addresses, I identified each speaker in the county's tax assessment rolls. Tax assessment rolls are public documents used to determine local property taxes. They identify and appraise the value of each land parcel in the locale, and thus include all landowners in a town. Of the 91 speakers who expressed a clear position, 83 were property owners in the town (64 opponents and 19 supporters). The reported average acreage is based on these property owners.

**Notes**

1. This pattern of local support for a project is also sometimes called "yes in my backyard" or "reverse NIMBY."
2. Gould (1995) focused on the structure of personal networks in his empirical analyses, but he defined participation identity more broadly. In particular, he focused on the material interests and collective identities that define a structurally equivalent class of actors that mobilize during a political contest. Walder (2009) provides a useful discussion of this element of Gould's work.
3. Although these applications likely overrepresent more favorable locations, they include applications for both targeted formations and were filed by six different gas companies, suggesting they are representative of the broad geographic pattern of the industry's interest in New York shale gas.
4. Recent scientific studies document adverse environmental impacts from fracking (Llewellyn et al. 2015), adverse health effects such as respiratory conditions and skin rashes (Rabinowitz et al. 2015), and animal deaths (Bamberger and Oswald 2012).
5. There is evidence that the potential economic benefits from shale gas development are overstated. Early research suggests, for example, that fracking-enabled development is prone to the boom-bust cycle common to extractive industries and that the jobs that accompany development tend to go to transient out-of-state workers (e.g., Christopherson 2011; Jacquet 2014).
6. An alternative approach to constructing the risk set is to include only the communities that lie above the targeted shale formations, rather than all 994 New York municipalities. Table S1 in the supplementary materials (http://asr.sagepub.com/supplemental) presents results using this alternative specification, which are consistent with findings based on the larger risk set. Given that nine communities not on any shale deposits passed bans, it is not clear where the boundary for the risk set should be drawn. Therefore, the approach I adopt here seems more principled. I include all municipalities in the risk set and model distant communities' relatively lower probability of adoption using several different specifications of the proximity variable.
7. Some towns passed multiple moratoriums (temporary bans, typically for a term of six to twelve months) during the study period, and some first passed moratoriums and then passed a ban. In all cases, the event is defined as the instance of the first passage of either kind of ordinance. A few additional municipalities passed ordinances since July 2013, but as Figure 1 shows, adoption slowed substantially by July 2013.
8. I was unable to obtain either the official minutes or a newspaper article confirming the dates for 7 of the 164 towns identified by at least one organization as passing a ban or moratorium. I omitted these towns from the analysis. These exclusions reduce the number of total municipalities to 987 and the number of towns with adopted bans to 157.
9. The list of coalitions comes from a directory compiled by Marcellus Drilling News, a pro-gas website: http://marcellusdrilling.com/landowner-groups/ (retrieved November 1, 2013).
10. These data are collected and maintained by Harvard Election Data Archive (Ansolabehere and Rodden 2011).
11. Unfortunately, even the 10-year ACS estimates have high margins of error for some of the smaller municipalities in my sample. To make sure that noise in the ACS variables (unemployment and education) did not influence my results, I re-ran the analyses only on communities with greater than 5,000 and greater than 10,000 residents; all the effects of interest are consistent with the presented results.

12. This variable is meant to capture a significant level of historic gas/oil activity. Thresholds above 250 wells yield consistent results. In robustness analyses, I used an alternative measure—the logged number of oil and gas industry establishments within the county (obtained from the Bureau of Labor Statistics). Models using this alternative variable yield consistent results.
13. I take the natural log of these last two variables, because of the high levels of skewness they display and indication from tests of Martingale residuals that log-transformed variables offer better model fit.
14. To ensure that the assumption of quadratic curvature is not driving this result, I fit several models using quantiles and linear splines, varying the number and positions of the knots (for results, see Table S2 in the supplementary materials). Results reinforce the substantive interpretation of the quadratic relationship—the probability of passing an ordinance increases with distance from proposed wells, reaches a high point in a sweet spot region between about 30 and 50 miles, and declines beyond this plateau. As further validation of the proximity variable as a measure of likely development, Figure S1 in the supplementary materials presents a ranking of Marcellus potential, plotted against a town's distance to the nearest proposed well. Consistent with the presented results, towns with the greatest development potential were least likely to pass bans.
15. Results of a test of Schoenfeld residuals are reported in Table A1 in the Appendix.
16. Table S3 in the supplementary materials presents an alternative specification that interacts the vote share variables with dummy variables for each year. This model finds a consistent trend for the Democratic vote share effect—an approximately linear increase over the four years. The effect is only significantly positive in 2012 and 2013. This model further suggests that the effect of Green Party vote share concentrates in the first year (2010) of the study period and is approximately zero during the other years—a nuance not picked up by the linear time specification presented here. Figure S2 in the supplementary materials presents this model's estimates of the marginal effects of the two vote share variables by year. In alternative specifications (not reported), I interacted the two variables with two other functions of time. First, my framework predicts that the effect of Democratic vote share would change with the volume of political debate surrounding fracking. To capture this directly, I specified the time function as the cumulative number of articles that mentioned "fracking" or "hydraulic fracturing" published in the *New York Times*. This alternative specification yields nearly identical fit to the simple linear function of time and entirely consistent results. Second, a model interacting the political profile variables with time squared also yielded significant interaction coefficients, but fit slightly less well than the interaction with linear time.
17. Results from Levene's test confirm that the differences are statistically significant for the latter period ($p < .01$ ) and not for the former.
18. Alternative specifications of the proximity variable (including splines with different numbers and locations of knots and quantiles) yielded results with a consistent substantive interpretation.
19. Part B of the Appendix provides details about how these data were collected.
20. Medians are presented because the mean values (10.7 acres and 197.8 acres for opponents and supporters, respectively) are skewed by outlier values.

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## SUPPLEMENTARY MATERIALS

**Table S1.** Partial Likelihood Estimates of the Passage of Anti-fracking Ordinances (risk set limited to communities lying above at least one of the targeted shale formations)

| Variable | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Log population | –.259* | –.393** | –.397** | –.312* |
| | (.116) | (.119) | (.119) | (.129) |
| Rural (D) | –.974** | –.771** | –.769** | –.536* |
| | (.221) | (.227) | (.227) | (.240) |
| Unemployment | –.0934 | –.0820 | –.0958 | –.0322 |
| | (.0964) | (.0959) | (.0964) | (.0948) |
| Oil/gas town (D) | –2.033** | –1.708* | –1.701* | –1.599* |
| | (.741) | (.745) | (.745) | (.743) |
| Education | .392** | .423** | .436** | .366** |
| | (.0877) | (.0883) | (.0878) | (.0917) |
| Log number of colleges/universities | .295** | .310** | .305** | .315** |
| | (.0843) | (.0834) | (.0848) | (.0798) |
| Miles to nearest well | .109** | .0894** | .0888** | |
| | (.0182) | (.0184) | (.0184) | |
| Miles to nearest well squared | –.00140** | –.00111** | –.00111** | |
| | (.000214) | (.000211) | (.000211) | |
| On Marcellus Shale (D) | | | | 1.089** |
| | | | | (.217) |
| Land owner coalition (D) | | | | –.690** |
| | | | | (.244) |
| Democratic vote share | .264* | .356** | –.197 | –.244 |
| | (.120) | (.125) | (.320) | (.317) |
| Green Party vote share | .0435 | .00309 | .518** | .528** |
| | (.0685) | (.0674) | (.177) | (.175) |
| Number of prior ordinances in county | | .114** | .113** | .148** |
| | | (.0170) | (.0170) | (.0172) |
| Democratic vote share × month | | | .0242 | .0221 |
| | | | (.0126) | (.0125) |
| Green Party vote share × month | | | –.0229** | –.0211** |
| | | | (.00749) | (.00741) |
| Likelihood ratio | 194.21 | 231.28 | 241.56 | 241.56 |
| *df* | 10 | 11 | 13 | 13 |

*Note:* $N$ = 85,348. Standard errors are in parentheses. All variables are standardized and centered at the mean, except distance to well, prior number of adoptions, and all dummy variables.
*$p$ < .05; **$p$ < .01 (two-tailed test).

**Table S2.** Partial Likelihood Estimates of the Passage of Anti-fracking Ordinances among New York Municipalities, March 2010 to July 2013 (alternative specification of proximity to well variables)

| Variable | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Log population | −.413** | −.414** | −.384** |
| | (.116) | (.116) | (.116) |
| Rural (D) | −.609** | −.684** | −.648** |
| | (.213) | (.219) | (.219) |
| Unemployment | −.0824 | −.0771 | −.0723 |
| | (.0916) | (.0921) | (.0922) |
| Oil/gas town (D) | −1.574* | −1.566* | −1.536* |
| | (.743) | (.743) | (.743) |
| Education | .387** | .381** | .374** |
| | (.0871) | (.0872) | (.0855) |
| Log number of colleges/universities | .261** | .233** | .209** |
| | (.0795) | (.0814) | (.0726) |
| *2-knot linear spline* | | | |
| 0 to 42.2 miles to nearest well | .0316** | | |
| | (.00917) | | |
| 42.2 to 74.9 miles to nearest well | −.0358** | | |
| | (.0107) | | |
| 74.9 or more to nearest well | −.189** | | |
| | (.0535) | | |
| *3-knot linear spline* | | | |
| 0 to 33.4 miles to nearest well | | .0589** | |
| | | (.0153) | |
| 33.5 to 58.5 miles to nearest well | | −.0273* | |
| | | (.0129) | |
| 58.5 to 84.3 miles to nearest well | | −.0582** | |
| | | (.0180) | |
| 84.3 or more to nearest well | | −.601 | |
| | | (.413) | |
| *Quantiles* × | | | |
| 2nd quantile (26.7 to 46.3 miles) (D) | | | .492* |
| | | | (.233) |
| 3rd quantile (46.5 to 65.1 miles) (D) | | | .402 |
| | | | (.236) |
| 4th and 5th quantile (65.2 to 191.0 miles) (D) | | | −1.414** |
| | | | (.308) |
| Democratic vote share | −.210 | −.184 | −.169 |
| | (.318) | (.319) | (.310) |
| Green Party vote share | .547** | .517** | .547** |
| | (.171) | (.171) | (.171) |
| Number of prior ordinances in county | .125** | .116** | .138** |
| | (.0169) | (.0173) | (.0170) |
| Democratic vote share × month | .0277* | .0273* | .0222 |
| | (.0123) | (.0123) | (.0120) |
| Green Party vote share × month | −.0220** | −.0216** | −.0206** |
| | (.00714) | (.00713) | (.00714) |
| Likelihood ratio | 308.42 | 315.49 | 259.67 |
| *df* | 14 | 15 | 14 |

*Note:* $N$ = 117,214. Standard errors are in parentheses. All variables are standardized and centered at the mean, except distance to well, prior number of adoptions, and all dummy variables. First quantile (0 to 26.7 miles from a well) is the reference group. Because no towns in the fifth quantile adopted an ordinance, I collapse it with the fourth.
*$p$ < .05; **$p$ < .01 (two-tailed test).

**Table S3.** Partial Likelihood Estimates of the Passage of Anti-fracking Ordinances among New York Municipalities, March 2010 to July 2013 (alternative specification of time interaction effect)

| Variable | Model 1 | Model 2 |
|---|---|---|
| Log population | –.398** | –.413** |
| | (.117) | (.117) |
| Rural (D) | –.641** | –.621** |
| | (.214) | (.214) |
| Unemployment | –.0712 | –.0841 |
| | (.0916) | (.0920) |
| Oil/gas town (D) | –1.642* | –1.543* |
| | (.742) | (.746) |
| Education | .384** | .372** |
| | (.0866) | (.0869) |
| Log number of colleges/universities | .249** | .252** |
| | (.0785) | (.0783) |
| Miles to nearest well | .106** | .107** |
| | (.0180) | (.0181) |
| Miles to nearest well squared | –.00133** | –.00135** |
| | (.000198) | (.000199) |
| Democratic vote share | 1.157* | |
| | (.475) | |
| Republican vote share | | –1.428* |
| | | ( .563) |
| Green Party vote share | .180 | .0304 |
| | (.284) | (.315) |
| Number of prior ordinances in county | .118** | .118** |
| | (.0167) | (.0167) |
| Democratic vote share x 2010 | –1.072 | |
| | (.556) | |
| Democratic vote share x 2011 | –.865 | |
| | (.490) | |
| Democratic vote share x 2012 | –.550 | |
| | (.489) | |
| Republican vote share x 2010 | | 1.257 |
| | | (.645) |
| Republican vote share x 2011 | | 1.093 |
| | | (.577) |
| Republican vote share x 2012 | | .700 |
| | | (.576) |
| Green Party vote share x 2010 | .444 | .571 |
| | (.321) | (.353) |
| Green Party vote share x 2011 | –.293 | –.183 |
| | (.299) | (.330) |
| Green Party vote share x 2012 | –.252 | –.191 |
| | (.296) | (.327) |
| Likelihood ratio | 325.37 | 328.42 |
| *df* | 17 | 17 |

*Note: N* = 117,214. Standard errors are in parentheses. All variables are standardized and centered at the mean, except distance to well, prior number of adoptions, and all dummy variable. 2013 is the reference year for vote share variables.
*$p < .05$; **$p < .01$ (two-tailed test).

**Table S4.** Replication of Models from Table 2 with Republican Vote Share Instead of Democratic Vote Share

| Variable | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Log population | –.266* | –.399** | –.402** | –.317** |
| | –.114 | –.117 | –.117 | –.122 |
| Rural (D) | –.806** | –.624** | –.626** | –.428 |
| | –.208 | –.213 | –.213 | –.228 |
| Unemployment | –.084 | –.078 | –.089 | –.01 |
| | –.093 | –.092 | –.093 | –.09 |
| Oil/gas town (D) | –1.838* | –1.502* | –1.511* | –1.508* |
| | –.742 | –.746 | –.746 | –.746 |
| Education | .330** | .355** | .365** | .323** |
| | –.086 | –.087 | –.087 | –.09 |
| Log number of colleges/universities | .237** | .257** | .246** | .243** |
| | –.078 | –.077 | –.078 | –.07 |
| Miles to nearest well | .122** | .106** | .107** | |
| | –.018 | –.018 | –.018 | |
| Miles to nearest well squared | –.00158** | –.00133** | –.00135** | |
| | –.000199 | –.000197 | –.000198 | |
| On Utica Shale (D) | | | | 1.552** |
| | | | | –.399 |
| On Marcellus Shale (D) | | | | 2.614** |
| | | | | –.386 |
| Land owner coalition (D) | | | | –.725** |
| | | | | –.243 |
| **Republican vote share** | **–.417**** | **–.513**** | **.195** | **.273** |
| | **–.132** | **–.137** | **–.342** | **–.329** |
| Green Party vote share | .018 | –.034 | .553** | .568** |
| | –.071 | –.07 | –.182 | –.178 |
| Number of prior ordinances in county | | .116** | .117** | .154** |
| | | –.017 | –.017 | –.017 |
| **Republican vote share × month** | | | **–.0304*** | **–.0256*** |
| | | | **–.013** | **–.0128** |
| Green Party vote share × month | | | –.026** | –.0229** |
| | | | –.008 | –.007 |
| Likelihood ratio | 262.71 | 302.96 | 314.99 | 274.51 |
| *df* | 10 | 11 | 13 | 14 |

*Note:* $N = 117{,}214$. Standard errors are in parentheses. All variables are standardized and centered at the mean, except distance to well, prior number of adoptions, and all dummy variables.
*$p < .05$; **$p < .01$ (two-tailed test).


**Figure S1.**Relationship between Estimated Marcellus Shale Potential and Distance to Nearest Proposed HVHF Well

*Note:* In a well-publicized report, Engelder (2009) classified New York counties into six tiers based on Marcellus development potential. Of New York's 62 counties, 17 were ranked. Counties in Tiers 1 through 4 constitute the core of the potential development region; unranked counties hold no development potential, either because they do not lie over any shale or because the shale does not contain recoverable gas. The tiers are presented on the *Y*-axis of the scatterplot, with unranked counties coded as 7. No New York county was rated better than Tier 3. The *X*-axis is the distance to the nearest proposed well; each black dot represents a New York municipality that passed an anti-fracking ordinance. Municipalities that did not pass an ordinance are plotted in gray (dots are jittered around the tier value to aid visualization). The fractions on the right side show the rate of ordinance adoption for each tier. Because these rankings do not consider Utica Shale potential, the tier ranking does not perfectly capture the likelihood of development. Nonetheless, the figure suggests that proximity is related to development potential. Moreover, it shows that the most lucrative areas were unlikely to pass bans, and the majority of bans passed in communities outside the projected core of the Marcellus development region.

**Reference**

Engelder, Terry. 2009. "Marcellus 2008: Report Card on the Breakout Year for Gas Production in Appalachian Basin." *Fort Worth Basin Oil & Gas Magazine* (August):19–22.

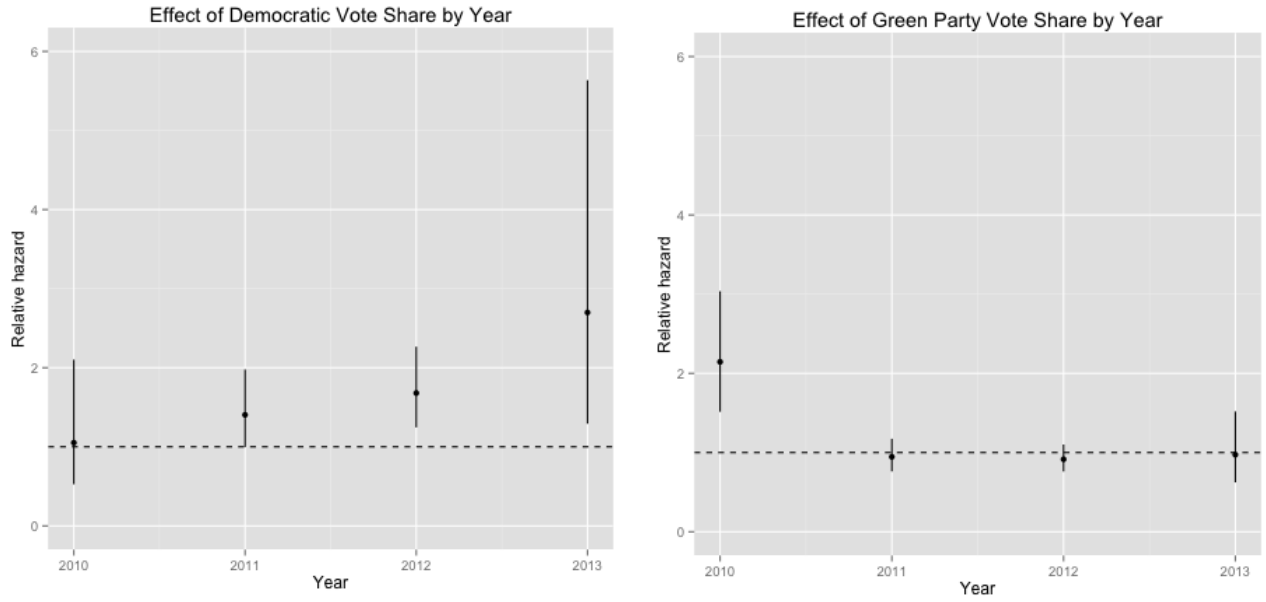


**Figure S2.** Marginal Effects of Political Profile Variables by Year
*Note:* Error bars represent 95% confidence interval. Estimates are from Model 1 of Table S3.

**Party over Town and Country: Explaining Mobilization for and against Hydraulic Fracturing among Residents of a Rural Community**


## ABSTRACT

This study uses behavioral data on public participation in a series of contentious town board hearings to examine local residents' responses to proposed gas development using hydraulic fracturing ("fracking") technology. By combining participant information from town board minutes with data from three additional databases—county tax assessment rolls, a database of gas leases, and the state voter registration file—I examine the relative influence of material interests and party affiliation on residents' opposition or support of a local law prohibiting fracking. Conditional on key measures of a resident's material interest in gas development, political partisanship remains a strong predictor of mobilization for and against the proposed fracking ban. The study challenges conventional images of local siting fights as being structured primarily by local concerns. I suggest that partisan identities may be especially important predictors of public participation, as opposed to survey-reported attitudes, due to the reputational costs and rewards self-identifying partisans face in deciding whether to endorse a position on a politicized issue. The study carries important implications for research on public response to industrial siting and for ongoing debates about the influence of partisan polarization on political participation.

## SMALL TOWN IN (A POLITICALLY POLARIZED) MASS SOCIETY

> "As a gasser walking into a [Town Board] meeting, I look for team jackets, denim and feed caps – the Walmart people. On the other side of the aisle, literally and figuratively, are the LL Bean people. I sit with the Walmarts.
>
> The class divide in this argument over drilling is the elephant in the room. [...] It's Brewery Ommegang/Bud Light,[1] opera season/deer season, those who work with their hands and those who work with their mouths. It's private college/community college, people up the back roads and folks who live in the village. It's old '60s radicals and those who did their tour of duty, Universal Unitarian social activists and Main Street Baptists. It's upstate/downstate, liberal/conservative. I could go on."
>
> -Dick Downey, gas drilling advocate and retired teacher from Otego, NY
> (In an op-ed in *The Daily Star*, March 11, 2011)

## INTRODUCTION

The "class divide" that Dick Downey, a gas drilling advocate from upstate New York, paints in the quote above is recognizable to most casual observers of American politics as a caricature of the political "culture war" narrative. The resonance of his imagery relates to the partisan polarization that characterizes the contemporary political climate in the United States (Abramowitz and Webster 2016; Baldassarri and Gelman 2008; DellaPosta, Shi, and Macy 2015). In the context of a debate over permitting gas development in his community, however, it is striking that Mr. Downey makes no mention of the significant material interests at stake. Indeed, his characterization of the conflict challenges the conventional image of public response to industrial siting, wherein residents are motivated primarily by perceived costs and rewards of proposed development (Esaiasson 2014; Schively 2007). We might be divided by partisanship about national priorities, conventional wisdom holds, but we are all pragmatists when a

[1] Brewery Ommegang is a craft brewery in Cooperstown, New York that specializes in Belgian-style ales.

hazardous facility is proposed in the backyard. Alternatively, the pull of partisanship weakens when locals in an oil or gas boomtown receive their first royalty checks.

Over the last several decades, however, a marked increase in partisanship has redefined the political landscape in the United States (Baldassarri and Gelman 2008; Abramowitz and Webster 2016). The present study uses the context of a local decision about a controversial land use, shale gas development using high volume hydraulic fracturing ("fracking"), to examine whether the high level of national partisanship might also permeate and structure local debates about the gas industry. The unfolding fracking boom provides an ideal context for examining this question. On the one hand, the substantial material interests at stake in the communities facing unconventional gas development suggest that residents' response should reflect pragmatic considerations of the underlying risks and potential rewards associated with development. On the other hand, fracking has emerged as the subject of intense politicized debate that has split national public opinion along partisan lines (Boudet et al. 2014; Davis and Fisk 2014; Mazur 2016). What motivates residents of a community facing the prospect of shale gas development to oppose or support the industry? Do residents mobilize on the basis of their perceptions of local impacts or do they defer to partisan positions despite the significant material interests at stake?

To address these question, I analyze primary data on residents' mobilization for and against shale gas development in the context of a local debate over a proposed zoning ordinance to prohibit the gas industry in a town in upstate New York. Methodologically, the article pioneers a new approach to studying public response to industrial siting by combining individual-level information from four sources of public administrative records. From the official town board minutes, I identify residents who spoke in favor or against the proposed fracking ban during a series of public hearings. I merge this measure of resident opposition or support with

information on local residents obtained from tax assessment rolls, county gas lease records, and the state voter registration file.

The study extends existing research in a number of ways. First, in the context of the unfolding boom in oil and gas production enabled by fracking technology, local governments have at times assumed a decisive role in the fate of unconventional gas and oil development (Dokshin 2016; Arnold and Neupane 2017). This study is the first to examine the public mobilization that underlies community decisions to prohibit hydraulic fracturing. Second, my analytic approach contrasts and improves upon the predominant practice in studies of public response of using attitudinal, survey-based measures. By obtaining a *behavioral* measure of opposition and support, I study public response *in situ*—in the natural context of a debate over a proposed local ordinance. This is critical for understanding public response, because people may hold private beliefs and may even express them in anonymous surveys, but these beliefs do not always translate into public action. Finally, I contribute to current scholarly debates about the impact of increasing partisan polarization on political participation.

To anticipate the results, evidence from multivariate logistic regression predicting support for the fracking ban suggests that while material interests are relevant, partisanship is the strongest predictor of whether a town resident publicly endorses the fracking ban. Compared to residents who are not registered to vote, being a registered Democrat is associated with a much higher probability of mobilizing against fracking, whereas being a registered Republican has a *demobilizing* effect. The opposite pattern is evident when examining opponents of the fracking ban, although data sparsity prevents a multivariate analysis for this outcome. Relating my results to recent survey-based findings, I emphasize the importance for researchers of public response to examine public actions as well as attitudes.

## EXPLAINING PUBLIC RESPONSE TO INDUSTRIAL SITING

Opposition to industrial sites has traditionally been seen as inspired by "Not in my backyard" (NIMBY) motivations (Esaiasson 2014; Kraft and Clary 1991; Schively 2007). People view proposed industrial sites to be harmful to their health, their property values, the local environment, and quality of life and they mobilize to prevent these negative effects. Researchers also find that there is sometimes support for proposed industrial projects (including hazardous ones), and that this is especially true when residents hold a positive financial stake in development or perceive other local benefits from the project (Boudet et al. 2016; Gravelle and Lachapelle 2015; Kunreuther and Easterling 1996).

Researchers have extended our understanding of the role that perceived costs and rewards play in public response to projects by emphasizing the significant uncertainty that characterizes siting debates (Slovic 1987). Uncertainty about the costs and benefits of proposed development leaves room for interpretation and thus helps explain the empirical variation in public response. Uncertainty foregrounds the mediating effect of local context on residents' opposition and support (Wright and Boudet 2012; Devine-Wright 2009). It also increases individuals' reliance on cognitive heuristics to make decisions and form opinions (Tversky and Kahneman 1974). Building on this insight, researchers have argued that political identity is often an important predictor of public response to industrial projects (Clarke et al. 2016; Michaud et al. 2008).

In the U.S. context individuals increasingly rely on their political identity, especially partisan identity, as an essential heuristic to form opinions on political issues (Baldassarri and Gelman 2008; Boutyline and Vaisey 2017). Over the last several decades, the United States has seen a dramatic rise in partisanship. This is observed not in greater prevalence of extreme views

among partisans (Fiorina and Abrams 2008), but in the increasing predictive power of partisan identification on the opinions people express on a range of issues (Baldassarri and Gelman 2008; Della Posta et al. 2015). Politics researchers now view partisanship as a salient and enduring social identity that promotes an emotional attachment to a party (Green, Palmquist, and Schickler 2002), drives engagement in political campaigns (Huddy, Mason, and Aarøe 2015), and is associated with increasingly negative feelings toward members of the opposing party (Abramowitz and Webster 2016; Iyengar and Westwood 2015).

There is strong evidence of partisan division in opinions toward controversial technologies and industries, including fracking. Examining attitudes toward offshore drilling, Michaud and colleagues (2008) find that Democrats view proposed offshore projects as more risky than Republicans. Several studies identify partisanship as a critical predictor of attitudes toward industrial infrastructure projects, including nuclear waste facilities (Jenkins-Smith et al. 2011) and oil pipelines (Gravelle and Lachapelle 2015). Most relevant for the present study, research on attitudes toward fracking finds partisanship and/or ideology (two increasingly correlated constructs in the U.S. [Levendusky 2009]) to be the strongest predictors of attitudes in samples of the U.S. population (Boudet et al. 2014; Davis and Fisk 2014). Finally, Christenson and colleagues (2017) find some support for the notion that partisans incorporate new information about fracking selectively, emphasizing information that shores up their prior views and discounting information that challenges their partisan predispositions.[2]

[2] The study finds that incorporation of new information about the benefits of fracking follows the expected motivated reasoning pattern, with Republicans strongly increasing their support for fracking after exposure and Democrats not changing their opinions. The study does not find significant results for new information about the environmental costs of fracking, however. In particular, Democrats do not oppose fracking more after receiving this information.

However, much of the empirical support for the role of political identity in driving public attitudes toward controversial industries comes from studies of national samples, in which respondents are only vaguely familiar with the relevant industry (Boudet et al. 2014; Davis and Fisk 2014; Christenson et al. 2017). Partisanship is a potent force in shaping people's attitudes, but its potency diminishes when debates become more localized and impacts more concrete (Bolsen and Druckman 2015; Sinatra, Kienhues and Hofer 2014; Trope and Liberman 2010). Studies that focus on the most directly impacted residents find that partisanship plays a diminished role. Clarke and colleagues (2016) find that survey respondents who live near active fracking wells are less likely to rely on partisanship as a heuristic for forming their opinion. Gravelle and Lachapelle (2015) identify the same tendency in the context of attitudes toward the Keystone XL pipeline. Political ideology predicts attitudes for more distant respondents, but liberals and conservatives who live closer to the pipeline report similar levels of support, conditional on multiple confounding variables. Thus, political identity holds substantial sway in national debates over controversial industries, but because people privilege proximate sources of information, its influence on residents of impacted communities is limited. We rely on political identities to guide our beliefs when considering industrial impacts in the abstract, but in our own backyards we look more closely at the associated costs and benefits.

This result introduces a puzzling tension. Partisan identities get their salience and potency from debates that happen at the national level (Abramowitz and Webster 2016). How do partisans cope with defending a position in a local debate that contradicts the views of their co-partisans across the country? Research shows that people's opinions are not good predictors of behavior (e.g., Hornsey et al. 2016). Emphasizing this reliable empirical result, I argue that to

understand the true impact of material interests and partisanship on public response it is critical to examine public *actions* as well as reported attitudes.

## MOBILIZATION AND DEMOBILIZATION OF PARTISANS IN LOCAL SITING CONTESTS

There is a disconnect between the concept of public response and the predominant method used to study it—the opinion survey. Public response to industrial siting is conceptualized as a behavioral reaction either in opposition or in support of a proposed project. For instance, in their classic article evaluating the NIMBY concept, Kraft and Clary (1991) explicitly link public response to proposed projects to concerted citizen participation in local politics. Anonymous opinion surveys provide important insight into people's attitudes, including perceptions of risks and rewards, but they do not reflect this fundamental conception of public response particularly well. This is not to suggest that analysis of public response should be limited to organized collective action, but at a minimum, what researchers measure should be both *public* and a *response* (i.e., an observable action). Behind this methodological critique is an important theoretical implication. Opinions can be held privately, but public participation is conspicuous and as a consequence entails additional *social* costs and rewards. To unpack the implications of this point, I distinguish between the mobilizing and *de*mobilizing effects of partisanship.

Public participation involves a dose of dramaturgy. This is perhaps most apparent at events like public hearings, where participants sometimes literally stand on a stage to deliver their comment. Because we attach meaning to political participation, there are social consequences to taking a public stance on a political issue. In the current highly partisan moment, U.S. Americans have a heightened inclination to see their political participation as

expressive of a partisan identity (Hersh 2017; Huddy et al. 2015). It follows that, for partisans, an important consequence of taking a public position on a politically charged issue is that it can reinforce or undermine this important social identity.

The implication for partisan mobilization is straightforward. A partisan identity motivates residents to express a view that conforms to the position of their partisan ingroup for solidary reasons. Previous research finds that people engage in a range of behaviors, including political participation as well as conspicuous consumption, to signal their political identities. Huddy et al. (2015) show that expression of a partisan identity explains contributions to political campaigns. In a study of pro-environmental behavior, Brick and colleagues (2017) find that the relative visibility of the behavior moderates the effect of an environmentalist identity on the adoption of that behavior. The more visible the behavior, the more likely environmentalists are to adopt it. Similarly, publicly registering an opinion that is consistent with one's partisan identity sends a valuable signal. In a local siting fight over a highly politicized industry, partisan expression may provide additional motivation for residents to take a public stance.

Researchers of political participation tend to focus on the factors contributing to mobilization (Schussman and Soule 2005), but factors that depress the chances of involvement among those otherwise disposed toward speaking out are equally important. We can glean some relevant lessons from recent research on the relationship between political identities and pro-environmental behavior. For instance, a study by Gromet et al. (2013) demonstrates political conservatives' aversion to signaling an endorsement of an environmentalist agenda. In a series of experiments, the authors find that, under null conditions, conservatives are as likely to pay extra for an energy-efficient lightbulb as liberals, but they avoid buying the same lightbulb when it is paired with a "Protect the Environment" sticker. Similarly, Brick and colleagues (2017) find

anti-environmentalists to be less willing to adopt pro-environmental behaviors when those behaviors are more visible, such as carrying a reusable grocery bag. In public response too, we should expect that partisans will be less likely to publicly advertise their views when those views might signal disagreement with ones championed by their partisan ingroup. Even residents who have vested interests in a policy position, and who privately support it, may decide to remain silent in cases where publicly endorsing that position would undermine their partisan identity.

To summarize, national-level politicization may structure local debates in two consequential ways: (1) by motivating partisans to mobilize when their views are consistent with the prevailing partisan view and (2) by attaching a reputational cost to a public response that would conflict with the prevailing partisan view, thereby demobilizing would-be participants.

## THE FRACKING DEBATE IN NEW YORK STATE—EMPIRICAL SETTING

The Southern Tier region in New York State lies above the Marcellus and Utica Shale formations, both identified as holding large amounts of natural gas (Wilber 2012). While there has been consistent if relatively low-volume gas development in the region for decades, the region began to attract significant interest from gas companies in the mid to late 2000s when innovations in hydraulic fracturing technology proved effective at extracting gas from the Marcellus in neighboring Pennsylvania. A frenzy of leasing activity spread across the region, and with it arose concern about the potential impact of gas development on local communities.

The stakes of the emerging debate were large. Landowners who leased their land for gas development could expect substantial royalty payments from gas extracted from beneath their properties (Wilber 2012). Residents who owned large parcels of land were especially well positioned to profit from gas development. Other locals worried that the industrial development

associated with fracking would have negative impacts on their communities (Jacquet 2012). Some reports from Pennsylvania, where drilling had been underway for several years, suggested significant costs to the local community from gas development. This included directly observable nuisances such as heavy truck traffic, increased crime, and a strain on local services, the latter two associated with the influx of transient gas company workers (Jacquet 2014). Impending development also increased fear of health and environmental impacts that were at the time poorly understood (Wilber 2012), and several of which have been confirmed since (Jackson et al. 2014; Rabinowitz et al. 2015). Finally, opponents emphasized the adverse effects that these negative impacts would have on property values, a concern that is especially salient for residents who have invested heavily in their residential properties.

This study examines political mobilization in one New York community: Rural Town, a pseudonym for a town on the northern edge of the Southern Tier Region. As the shale gas boom heated up, communities like Rural Town were caught at the crossroads of the debate over how to respond to the prospect of unconventional gas development. In Rural Town, concerned residents began to advocate for local protections against fracking in 2010. They pursued a public outreach campaign, including a door-to-door petition drive, and pressured town board officials to pass a zoning ordinance to prohibit fracking, a goal they achieved in August of 2011. The analysis that follows examines public participation in four public hearings about the proposed ban.

## ANALYTIC PLAN: MEASUREMENTS AND METHODS

### *A Behavioral Approach to Measuring Public Response to Industrial Siting*

Existing research on public reactions to industrial siting relies overwhelmingly on survey methods, which are limited in critical ways. Most importantly, it is not clear whether a response

to a survey question relates to a real-world behavior, which is often of ultimate interest to the researcher of public response (e.g., Hornsey et al. 2016). As Perrin and McFarland (2011) remind us, the artificial setting of the survey removes many of the processes that are understood to be part of expressing an opinion. These include the initial decision that an issue is worth considering in the first place, the process of forming an opinion (as opposed to selecting from the researcher's preconceived menu of items), and delivering the opinion in the context of a relevant public. Indeed, research finds that survey respondents will offer opinions even on issues that are fictitious or unreasonably obscure (Sturgis and Smith 2010). Besides these conceptual challenges, surveys face methodological constraints including low (and falling) response rates (Dillman, Smyth, and Christian 2014), question-order and other priming effects (Krosnick and Alwin 1987), and difficulties in obtaining representative samples of the population of interest (Dillman et al. 2014). From this perspective, the use of behavioral data is a key advantage of the present study.

I use public records to identify town residents who took the significant step of submitting a public comment on the proposed law. Participation in the public comment period is a behavioral indicator of mobilization and the content of the comment reveals the participant's position on the issue. Using public records presents some unique challenges. It is straightforward to identify participants from public records, but additional information is required to make meaningful statistical inferences. First, we require information not only about those residents who mobilized, but also those who could have mobilized but did not. In other words, we need to define an appropriate population of *possible* participants. Second, in a survey study the researcher simultaneously collects information on the outcome variable as well as covariates of interest. But how to obtain information on important explanatory variables without a survey?

Below, I outline a novel approach, which combines four independent sources of administrative records to obtain a measure of opposition or support as well as key variables for a population of potential public hearing participants in Rural Town.

*Dependent Variables*

First, I use the official town board records to identify residents who participated in town board hearings about gas drilling in the town. I examined the meeting minutes for every session that the town board held for any discussion of the gas drilling issue. There were four official public hearings held about the proposed zoning law. In addition to public comments made in person at the town hall, residents could provide comments by email. All recorded in-person comments included the participant's name, address, and public comment and nearly all emailed comments included all of this information, although a few had missing addresses. I coded each participant's comment as either for or against the proposed law banning hydraulic fracturing in the town. Of the 269 total participants all but 3 included a clear statement in favor of or in opposition to the ban. I use this information to create two dependent variables, one indicating the resident's expression of support to the proposed fracking ban and one indicating opposition to the ban.

*Defining the Study Population*

Next, I use the tax assessment rolls to identify all property-owning residents in Rural Town. In New York State, county governments compile assessment rolls annually for the purpose of levying local property taxes. These documents appraise the value of each land parcel in the locale and include the names and addresses of every owner of that parcel as well as descriptive information about the parcel. I use the list of property owners in the tax assessment rolls to

define the study's population of interest. Notably, using the tax assessment rolls to define the population excludes anyone who is not listed as an owner of at least one parcel of land in the town. In Rural Town, 67% of the population lives in owner-occupied households.[3] Although exclusion of renters from the population is a limitation of this research design, the high level of home ownership rate in Rural Town, especially compared to communities in more urban settings, gives us confidence that the defined population is a meaningful one. Additionally, property owners are most invested in local zoning and siting debates, which provides further justification for defining the population in this way.

Using the 2010 tax assessment roll, I compiled a list of 6,617 residents, which included 81% of the participants in the town board comment sessions. Of the speakers not found in the tax assessment rolls, 23 (8.6%) were not residents of Rural Town, 5 (1.9%) reported a Rural Town address but were not present in the tax assessment document (indicating that they were not property owners in the town), and 17 (6.3%) did not report an address and could not be matched to a record in the tax assessment roll.

*Assembling Key Covariates*

In addition to defining the study population, tax assessment rolls contain information on several covariates of interest. First, I create a measure of investment in the property, equal to the fair market value assessed to the property minus the assessed value of the land. This value reflects an estimate, made by a certified assessor, of the market value for any buildings or structures on that land.[4] Residents who have invested more in their property are expected to have greater interest in

[3] Source: 2010 Census.

[4] The Institute of Assessing Officers defines fair market value as "The most probable sale price of a property in terms of money in a competitive and open market, assuming that the buyer and

reducing the risk of industrial siting. A main concern of local opponents of hydraulic fracturing was the adverse effect it would have on residential property values. Second, I use property classification codes to create a dummy variable indicating that a property is a residential one, as opposed to a business, a farm, or vacant land. Classification codes are assigned by an assessor to indicate the primary use of each parcel of property. Third, I create a variable for the amount of land that each resident owns in the town. Size of land owned is an important indicator of the potential for economic gain from gas development. As the drilling boom unfolded, residents with large tracts of land stood to gain financial rewards from leasing their properties for development by gas companies. Because the distribution of acreage is highly skewed in this population, I perform a log-transformation of this variable.

A more direct measure of interest in gas development is a signed gas lease. I obtain information on whether a resident holds a gas lease from a separate county database. Gas leases are required to be registered with the county clerk's office. I obtained all records of gas leases signed between January 1, 2005 and December 31, 2011. This search resulted in 574 individual leases, associated with 774 unique Rural Town landowners. In total, 11% of Rural Town's landowners held a gas company lease. It is worth emphasizing that holding a gas lease is not by itself an indicator of support for hydraulic fracturing to be used in the town. Many landowners leased their land before they knew anything about hydraulic fracturing. Conventional gas development techniques leave smaller footprints, so some landowners may have been leasing their land with that technique in mind, and would not have offered their land for the more intensive unconventional technique. Regardless of intention, holding a lease is a credible

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seller are acting prudently and knowledgeable, allowing sufficient time for the sale, and assuming that the transaction is not affected by undue pressures."

indicator that the landowner would stand to receive a financial reward if gas development were to commence in the town. Further, the reward would be greater for landowners with larger parcels of land under lease.

A final source of administrative data is the New York State voter registration file, which I use to identify residents' political affiliations. The New York voter registration file lists every registered voter in the state. In addition to each voter's party affiliation (if any), each record of the voter registration file includes the person's age, gender, and history of participating in elections. I use the voter registration file to create two versions of political identity measures. First, I simply create a series of dummy variables for each registration status. These include: registered Republican, registered Democrat, registered Green Party member, registered Independent, and registered unaffiliated voter.[5] Unregistered voters form the reference category. Second, I make use of the voting history information to further subdivide Republicans and Democrats by intensity of partisanship. Voting in party primaries is associated with stronger partisan commitment, so I indicate a resident as a strong Republican or a strong Democrat, if they voted in a primary election of their party in the last five voting cycles.

*Matching Records across Four Databases*

[5] There are two additional, relatively strong third parties in New York: the progressive Working Families Party and the conservative Conservative Party. While the Working Families Party and Conservative Party are organizationally independent from the two major parties, in all recent elections they have co-nominated the Democratic and Republican candidates for Governor, respectively (this co-nomination is a somewhat unique feature of NY election law). Because they comfortably sit on the same dimension with Democrats and Republicans, I collapse Working Families Party affiliates with Democrats and Conservative Party affiliates with Republicans. Including these parties separately yields consistent results and little additional information.

A unique challenge of using data from multiple distinct administrative databases is matching records without the benefit of unique identifiers. I used an algorithm to match records based on residents' names and addresses. Starting with 6,617 unique individual landowners in the tax assessment rolls, I matched 68.4% with a unique record in the NYS voter registration file. The match rate corresponds closely with the state average registration rate of 68%. Each land parcel is assigned a unique parcel ID, which enabled me to reliably match every gas lease record with its corresponding parcel in the tax assessment rolls.[6]

*Analytic Strategy and Model Selection*

Using four public databases, I was able to obtain resident-level information on key explanatory variables. These include, critically, measures of material interest in gas development as well as of partisan affiliation. Ideally, we would like to have additional covariates (e.g., education and information on residents' social networks or organizational affiliations) that would further help us tease out confounding relationships, but it is not feasible to obtain these in the context of our behavioral outcome. Cross-sectional, observational data in general are rarely amenable to developing a credible identification strategy (Morgan and Winship 2014), and so we must be satisfied with more modest goals. We use a multivariate approach to describe the key relationships in the data and interpret the results in the context of the limitations of the data.

[6] All of the data used here are in the public domain, but compiling information from across these four public data sources allows the researcher to collect significant details on living individuals, identified with their names and addresses, which raises important privacy concerns. I take several precautionary steps to protect people's identity. First, I use a pseudonym instead of the town's real name. Second, after compiling the dataset, I de-identified the individual records, and completed all analysis on an anonymized dataset. Third, I stored all data that includes identifying information on a secure server.

Table 1. Summary of variables (non-transformed)

| Statistic | Mean | St. Dev. | Min | Max |
|---|---|---|---|---|
| Fracking ban supporter | 0.030 | 0.170 | 0 | 1 |
| Fracking ban opponent | 0.003 | 0.054 | 0 | 1 |
| Gas lease | 0.117 | 0.321 | 0 | 1 |
| Acres of land | 8.963 | 26.800 | 0.00001 | 561.690 |
| Residential property | 0.896 | 0.305 | 0 | 1 |
| Investment (10K) | 14.316 | 8.923 | 0.000 | 50.000 |
| Not registered to vote | 0.316 | 0.465 | 0 | 1 |
| Democrat | 0.270 | 0.444 | 0 | 1 |
| Republican | 0.247 | 0.432 | 0 | 1 |
| Green Party | 0.003 | 0.059 | 0 | 1 |
| Unaffiliated voter | 0.139 | 0.346 | 0 | 1 |
| Registered independent | 0.024 | 0.153 | 0 | 1 |
| Primary Democrat | 0.128 | 0.334 | 0 | 1 |
| Primary Republican | 0.099 | 0.299 | 0 | 1 |

There are two binary outcomes of interest: (1) mobilization in support of the fracking ban and (2) mobilization in opposition of the fracking ban. I use logistic regression to model residents' mobilization in support of the fracking ban. There are only 19 cases of mobilization in opposition to the ban, which is not enough to accommodate a multivariate analysis, so for this outcome I adopt a straightforward non-parametric approach—directly presenting contrasts between key resident subgroups. Descriptive statistics of the variables used in the analyses are presented in Table 1.

**RESULTS**

Table 2 compares the averages of key variables across three groups of Rural Town residents: supporters of the ban, opponents of the ban, and those who did not publicly participate in this debate. Differences between opponents and supporters are immediately apparent. Compared to the opponents of the fracking ban, supporters of the ban own fewer acres of land, are less likely to hold a gas lease, are more likely to live on residential lots, are more likely to be registered as Democrats, and less likely to be registered as Republicans. Residents who did not participate in the debate (column 3) occupy intermediate values, with the exception of investment in the property and acreage owned. Non-participants own the smallest land parcels of the three groups and have the least invested in their properties, on average. Supporters and opponents have similar levels of investment (just under $170,000), whereas non-participants invest less on average ($128,900). This is consistent with the long-standing result that rates of political participation are higher among wealthier segments of the population (Verba and Nie 1987).

Table 2. Comparison between ban supporters, ban opponents, and non-participants

| | Ban supporters | Ban opponents | Neither supporters nor opponents |
|---|---|---|---|
| Average acres owned (median) | 2.9 | 61.9 | 1.7 |
| Percent who hold a gas lease | 8.1% | 36.8% | 11.7% |
| Percent with residential property | 97.5% | 63.2% | 89.5% |
| Average investment (median) | $169,100 | $167,900 | $128,900 |
| Percent registered Democrats | 56.3% | 5.2% | 26.1% |
| Percent registered Republicans | 8.1% | 68.4% | 25.1% |
| N | 197 | 19 | 6,401 |

These group averages are consistent with our expectation that partisan identity played a decisive role in structuring residents' mobilization around the proposed fracking ban. However, if Republicans, for example, are overrepresented among large landowners or among gas lease holders, then the apparent influence of partisanship may be spurious. In Table 3, I present results from multivariate logistic regression models predicting mobilization in support of the proposed fracking ban. The two continuous variables (investment and the logarithm of property size) are centered on their means to aid interpretation. Model 1 includes just the material interests variables. As expected, holding a gas lease is negatively associated with mobilizing to support the fracking ban. Exponentiating the coefficient to an odds ratio, we see that holding a gas lease is associated with a 60% decrease in the odds of publicly supporting the ban, according to this simple model. Model 2 includes an interaction between the gas lease variable and the landowner's logged property size. Inclusion of this term reveals that the negative effect of holding a gas lease is driven primarily by larger landowners. Figure 1 displays the predicted probabilities of expressing public support for the ban by acres owned and lease status (calculated from the full model [Model 4]). Holding a lease is not associated with a significant difference in the probability of mobilizing for small landowners. The probabilities diverge among larger landowners, with leaseholders' chances of mobilizing to support the ban dropping to near zero for the largest landowners.

Table 3. Coefficients from logistic regression models predicting mobilization in support of the ban on fracking

| | *Dependent variable:* | | | | | |
|---|---|---|---|---|---|---|
| | Mobilized in support of fracking ban (=1) | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Gas lease | -0.913** | 0.014 | | 0.184 | 0.191 | 0.462 |
| | (0.288) | (0.337) | | (0.340) | (0.342) | (0.441) |
| Ln(Acres of land) | 0.262** | 0.311** | | 0.333** | 0.326** | 0.336** |
| | (0.056) | (0.057) | | (0.058) | (0.059) | (0.059) |
| Gas lease X Ln(Acres of land) | | -0.537** | | -0.572** | -0.567** | -0.584** |
| | | (0.166) | | (0.167) | (0.168) | (0.168) |
| Residential property | 1.436** | 1.386** | | 1.206* | 1.196* | 1.223* |
| | (0.464) | (0.465) | | (0.475) | (0.476) | (0.476) |
| Investment (10K) | 0.035** | 0.035** | | 0.033** | 0.033** | 0.030** |
| | (0.007) | (0.007) | | (0.008) | (0.008) | (0.012) |
| Democrat | | | 1.200** | 0.918** | | 0.898** |
| | | | (0.186) | (0.191) | | (0.206) |
| Republican | | | -0.705* | -0.936** | | -0.745* |
| | | | (0.297) | (0.301) | | (0.313) |
| Green Party | | | 2.355** | 2.379** | 2.379** | 2.356** |
| | | | (0.572) | (0.585) | (0.585) | (0.586) |
| Unaffiliated voter | | | 0.156 | -0.149 | -0.146 | -0.149 |
| | | | (0.271) | (0.277) | (0.277) | (0.279) |
| Registered independent | | | 0.256 | 0.006 | 0.006 | -0.006 |
| | | | (0.530) | (0.536) | (0.536) | (0.537) |
| Primary Democrat | | | | | 1.410** | |
| | | | | | (0.201) | |
| Non-primary Democrat | | | | | 0.125 | |
| | | | | | (0.256) | |
| Primary Republican | | | | | -1.366** | |
| | | | | | (0.528) | |
| Non-primary Republican | | | | | -0.736* | |
| | | | | | (0.335) | |

*(continued on next page)*

| | | | | | | |
|---|---|---|---|---|---|---|
| Republican X Gas lease | | | | | | -0.364 |
| | | | | | | (0.557) |
| Democrat X Gas lease | | | | | | -1.018 |
| | | | | | | (1.107) |
| Republican X Investment (10K) | | | | | | 0.011 |
| | | | | | | (0.015) |
| Democrat X Investment (10K) | | | | | | -0.029 |
| | | | | | | (0.029) |
| Constant | -4.882** | -4.850** | -3.913** | -4.928** | -4.919** | -4.963** |
| | (0.458) | (0.458) | (0.158) | (0.465) | (0.466) | (0.467) |
| Observations | 6,617 | 6,617 | 6,617 | 6,617 | 6,617 | 6,617 |
| Log Likelihood | -843.103 | -838.124 | -837.045 | -795.111 | -776.271 | -793.382 |
| Akaike Inf. Crit. | 1,696.206 | 1,688.248 | 1,686.090 | 1,612.223 | 1,578.542 | 1,616.763 |

*p<.05; **p<0.01

Other measures of material interests also appear to be relevant predictors of mobilization. Individuals who own residential properties are more likely to support the ban than owners of commercial, agricultural, or vacant parcels. Finally, the probability of mobilizing in support of the fracking ban increases with greater investment in one's property. Every additional $10,000 invested in structures on the property is associated with a 3.0% increase in the probability of speaking out in support of the ban (calculated from Model 4).

Model 3 displays the unconditional effects of different political identity groups and Model 4, the full model, includes both the material interests and political identity predictors. Residents who are not registered to vote form the reference group, thus the effects of party affiliation are interpreted as changes from this baseline. Being not registered to vote does not mean someone is apolitical, but it does suggest the absence of a strong partisan identity and therefore represents a meaningful contrast to individuals with avowed partisan commitments.

Further, the mobilization rate of unregistered individuals does not significantly differ from the rates of either the registered Independents or from the registered but unaffiliated voters (see Models 3 and 4). This provides additional confidence that the reference group offers a meaningful baseline with which to contrast behavior by partisan residents. An increase from the baseline would suggest a mobilizing effect and a decrease would suggest a demobilizing effect.

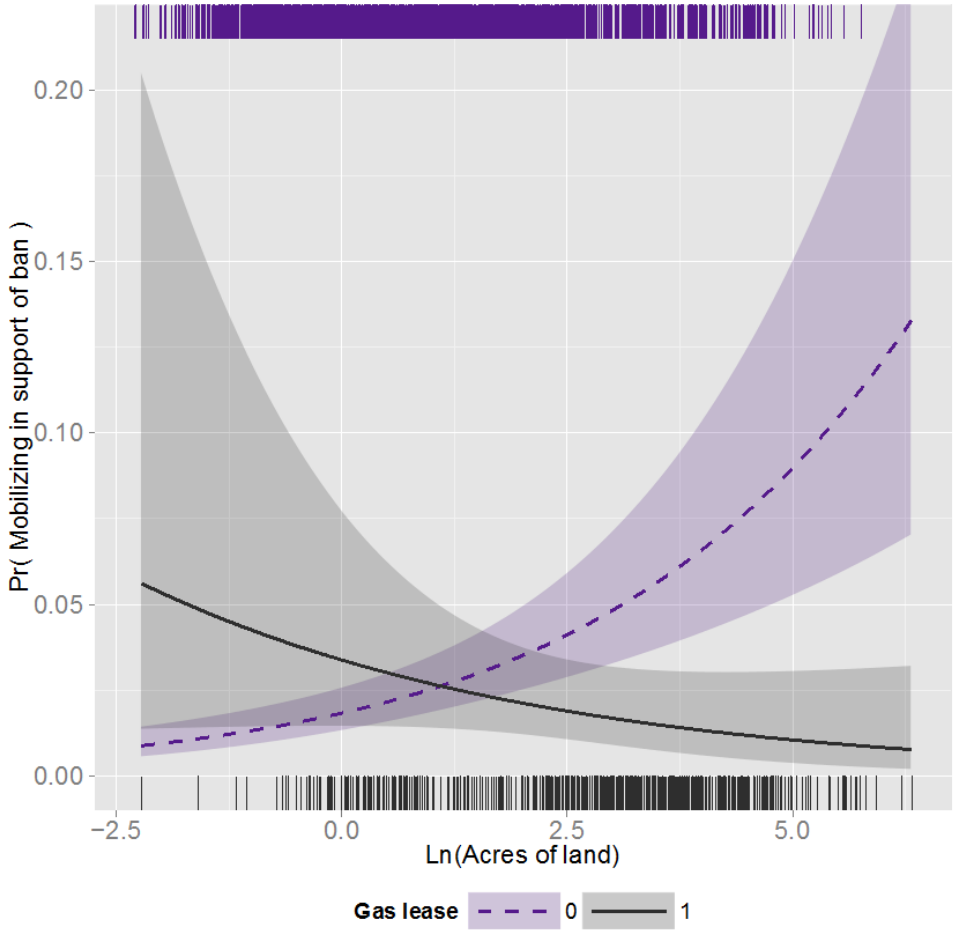


Figure 1. Predicted probabilities of mobilizing in support of the fracking ban by acres owned and gas lease status. Rug plots display the distributions of Ln(Acres of land) for residents with a gas lease (bottom) and without a gas lease (top).

Figure 2 displays the predicted probabilities by party affiliation for the major comparisons (the plot omits the other three categories to aid visualization; a plot with the full set

of categories is found in the Supplementary Materials). A resident who is not registered to vote, who owns a residential property of average size and with average investment, and holds no gas lease has a 2.4% probability of mobilizing in support of the ban. Compared to the unregistered resident, a registered Democrat with an otherwise identical profile is 2.4 times more likely to publicly support the ban (5.7%). This result supports our expectation of a mobilizing effect of Democratic political identity. In contrast, a Republican resident with the same characteristics has less than a one percent chance of mobilizing (.9%). A Republican is 2.6 times less likely to mobilize than an unregistered resident, suggesting the presence of demobilizing pressure on Republicans.

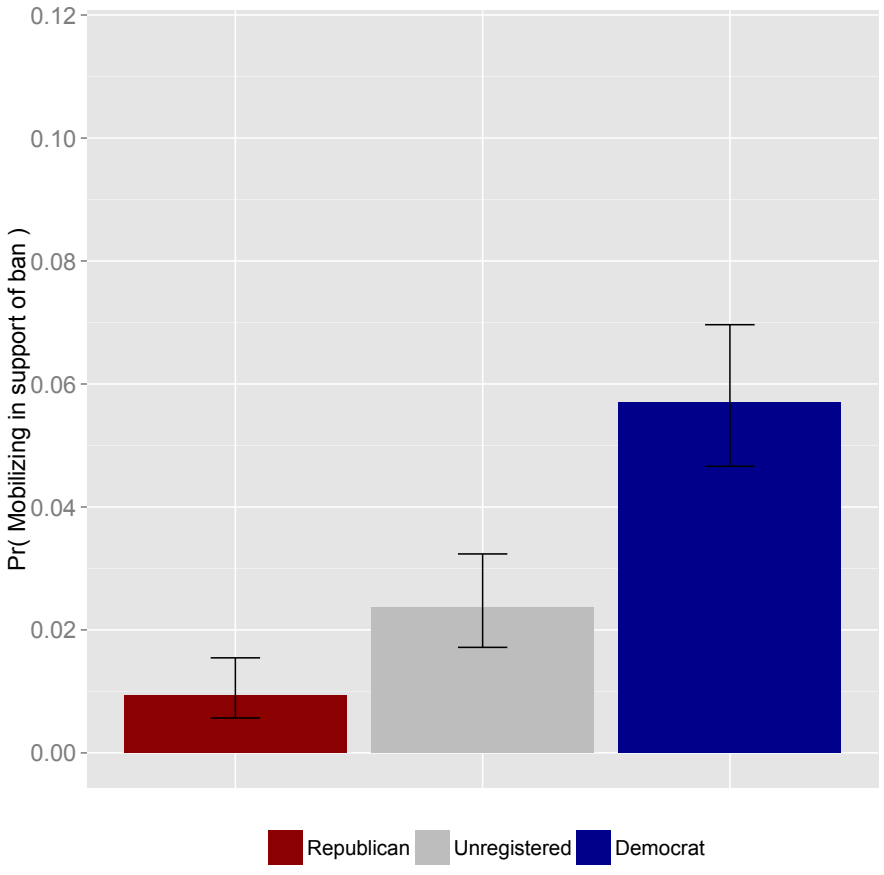


Figure 2. Predicted probabilities of mobilizing in support of the fracking ban by party affiliation. Values for other variables are as follows: gas lease = 0; Ln(acres of land) = .75 (mean); residential property = 0; Investment = $140,316 (mean). 95% confidence intervals shown.

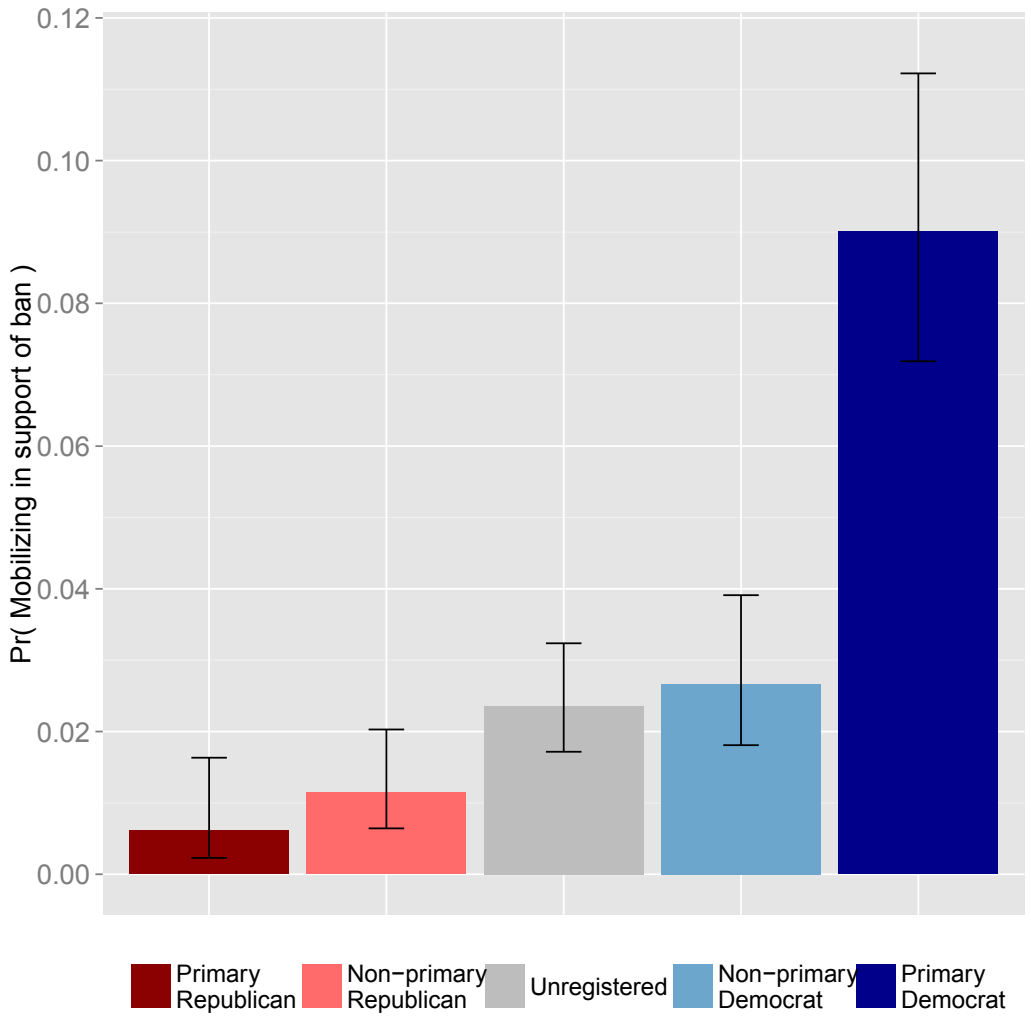


Figure 3. Predicted probabilities of mobilizing in support of the fracking ban by party affiliation, including primary voters. Values for other variables are as follows: gas lease = 0; Ln(acres of land) = .75 (mean); residential property = 0; Investment = $140,316 (mean). 95% confidence intervals shown.

As a further test of the importance of partisan identity, I distinguish between partisans who recently voted in their respective primary elections and partisans who do not vote in primaries. Partisan identity is expected to be more salient for individuals who vote in primaries and therefore the mobilizing and demobilizing effects should be more pronounced for these more intense subsets of partisans. Model 5 in Table 2 reports results from this respecification. The

results, presented as predicted probabilities in Figure 3, show an even more striking contrast for the strong partisans. Other variables are held constant at the same values as were used to generate Figure 2. Republicans who recently voted in their party's primaries have the lowest predicted probability of supporting the ban at just .61%. Unregistered voters are at 2.4%, while primary-voting Democrats are predicted to support the ban at a rate of 9.0%, nearly fifteen times the rate at which primary-voting Republicans mobilized. The 95% confidence intervals for both primary-voting groups lie outside of the confidence interval for unregistered voters, signifying support for both the mobilizing effect of Democratic partisan identity and the demobilizing effect of strong identification with the Republican Party. Consistent with expectations, Democrats and Republicans who did not vote in the primaries show intermediate rates of mobilization, higher and lower than the unregistered individuals, respectively. While the point estimates fit the expected pattern, the differences are not statistically significant as indicated by overlapping confidence intervals.

One possibility is that partisan identity might have the greatest influence among those who have little at stake, but material interests trump partisan identity when interests align especially strongly with one side or the other. If this were the case, we should see a depressed effect of Democratic identity among gas lease holders and a depressed effect of Republican identity among residents who are heavily financially invested in their properties. Model 6 includes interactions between partisan identity and the two material interests variables. There is no evidence of a negative interaction effect between holding a lease and identifying as a Democrat, suggesting that the positive influence of Democratic identity on mobilization holds even for groups whose interests might predispose them to adopt a view contrary to their co-

partisans.[7] Similarly, we see no evidence that the effect of partisanship diminishes among heavily invested Republicans. Democratic partisanship reliably predicts mobilization and Republican partisanship reliably predicts demobilization across the spectrum of residents' private interests.

Next, we turn to a closer examination of the 19 opponents of the fracking ban. Unfortunately, the relatively low number of ban opponents does not permit us to conduct a fully-fledged multivariate analysis. There are a number of reasons why pro-fracking participation was lower than resident support for the proposed town ban, despite opinion polls showing an approximately even split in upstate New York residents' attitudes toward fracking (Siena College Research Institute 2011). First, because ban opponents' favored position was the status quo, they did not organize as actively as the ban proponents—who knew they needed large numbers to push through a policy change. Second, opponents of the ban could count on other channels to influence the political process. This included industry representatives putting direct pressure on the town board by presenting the economic case for development and, in communities where bans were considered, threatening or taking legal action against the town (Wilber 2012). Despite the more elite-driven politics of fracking proponents (Arnold and Neupane 2017), sympathetic community residents did get involved. As the ban campaign heated up in Rural Town, 19 town landowners publicly spoke out against the measure. Who were they?

[7] Interpreting interaction effects from logistic regression models presents unique challenges due to the non-linearity of the link function (Ai and Norton 2003). The difficulty is compounded for probabilities near the bounds (0 and 1), which is the case in our model. Following Greene's (2010) recommendation, I examine the pattern of interaction graphically and still find no evidence of the specified interaction effects.

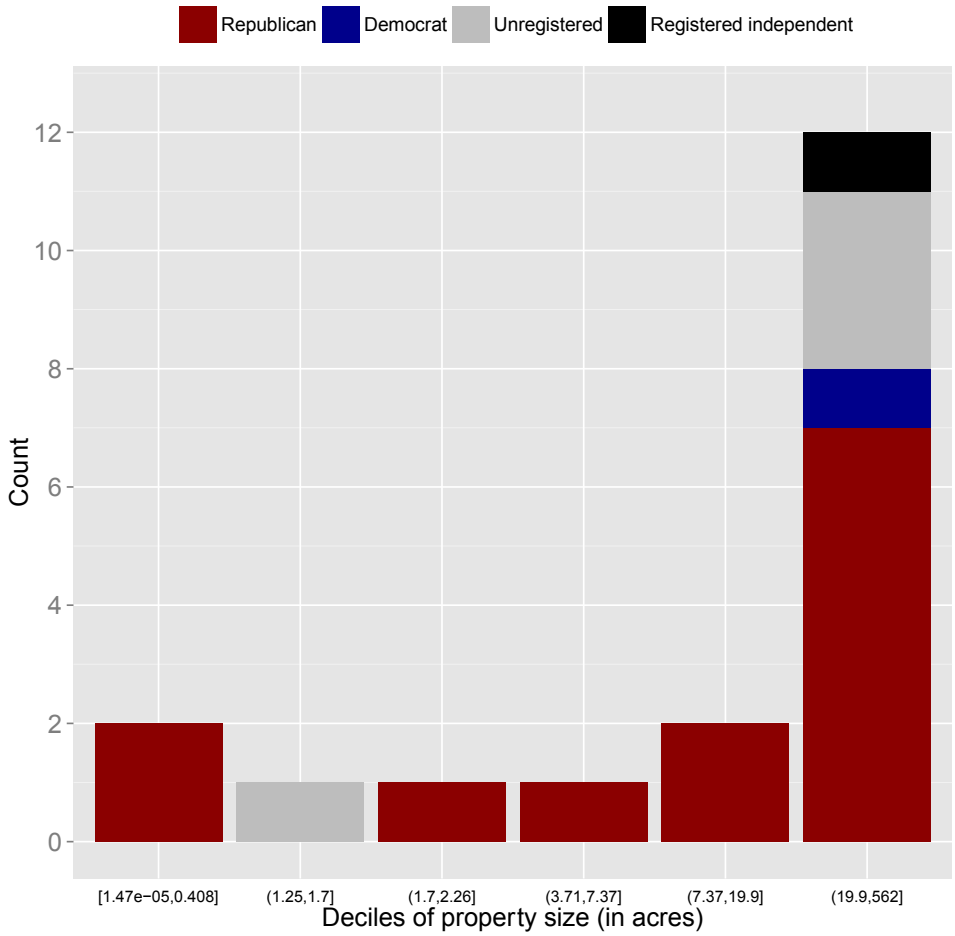


Figure 4. Distribution of acres owned among the 19 opponents of the fracking ban by party affiliation.

Figure 4 shows the distribution of property size among ban opponents. The bins in the bar graph represent deciles of the property size variable in the entire population, which means that a random sample would have bars of equal height. Opponents of the ban, however, concentrate among the largest landowners, with 12 of the 19 (63%) coming from the top decile of the property size distribution. Additionally, as reported in Table 2, 37% of ban opponents hold a gas lease, more than three times the overall rate in the town. This supports the idea that material interest motivates political participation among advocates of gas development.

Figure 4 additionally breaks down the distribution by party affiliation. Republicans are overrepresented across the range of parcel sizes. 13 of the 19 ban opponents (68%) are registered Republicans. Among them, 9 recently voted in the Republican primaries, suggesting a strong partisan commitment. The other six ban opponents include four unregistered voters, a single registered Independent and a single Democrat. Notably, there are many Democrats who might be expected to mobilize based on their material interests, but did not. 143 Democrats in Rural Town held gas leases, 57 of which were on parcels larger than 20 acres (top 10% in the town). Not one of these Democratic leaseholders defended their interest in developing gas from under their property by speaking against the proposed fracking ban.[8] Given the small number of town residents who publicly opposed the ban, we cannot draw strong conclusions. Nonetheless, the suggestive evidence is consistent with the expectation that partisan identity was an important factor for people's public participation. Partisanship appears to have legitimized public opposition to the ban among Republicans and undermined the legitimacy of adopting this public position among Democrats.

## DISCUSSION AND CONCLUSIONS

This study presents the first systematic analysis of public participation in a town debate over whether or not to prohibit hydraulic fracturing. Such community debates have received significant public attention in popular print (McGraw 2012) and in two major films (Vasi et al. 2015). The animating narrative in these accounts is consistent: as the prospect of a gas-drilling boom becomes real, previously amicable neighbors become divided by competing interests and visions of community (see also Wilber 2012). The key dimensions of the division are presented

[8] The single Democrat who spoke in opposition of the ban did not hold a lease on his 56-acre lot.

as orthogonal to the national partisan debates, which pale in salience compared to the transformative realities of the potential drilling boom. Yet, the foregoing analysis of Rural Town residents' political behavior contradicts this account. Partisan division fundamentally structured the pattern of public response in this community. Democratic residents were much more likely to take a public stand against fracking than unregistered or unaffiliated residents. Republicans, by contrast, supported the ban at rates that were substantially lower than their unregistered or unaffiliated neighbors and were overrepresented among ban opponents.

Importantly, my results do not contradict research on public attitudes toward fracking that find a diminishing role for political identity among respondents who are more proximate to development (e.g., Clarke et al. 2016), rather they suggest that the previous account is incomplete. It may be that partisanship does not predict residents' privately held attitudes toward fracking as strongly as it predicts public displays of opposition or support. Residents whose privately held attitudes conflict with their partisan identities may be systematically underrepresented among the mobilized public. This is why research on public response to new industries must examine not only attitudes, but also actions.

A shift in attitude does not predict a proportional shift in probability of taking a public action (e.g., Hornsey et al. 2016). Political participation implies *social* costs and benefits that are absent or less salient in the context of an anonymous survey. This may be especially consequential in the context of a nationally politicized issue like fracking. In such cases, partisans use participation as a valuable signal of an important identity, thereby accentuating the predictive power of partisanship for mobilization, but not necessarily for private belief. Meanwhile, a "spiral of silence" dynamic (Noelle-Neumann 1993) may take hold among partisans whose private views conflict with their partisanship. This means, that Republicans who

privately oppose fracking may be unwilling to publicly disclose that view out of fear of losing status among co-partisans. This could hold even if there are many co-partisans in the community who privately share this view. Because my data did not contain measures of attitudes, I could not examine whether such decoupling between opinion and behavior took place in Rural Town. But such processes have potentially important implications for understanding public response to industrial siting and for democratic representation generally. Future research should seek to collect measures of both attitudes and behavior to directly examine the relationship between these in the context of politicized issues.

There are several limitations of the current study that are important to document. First, the study was limited to a single community and so we should exercise caution in generalizing these results. Future research might examine if the pattern holds in other communities and also on other politicized issues (e.g., siting of pipelines or power plants). Second, the results should be read in the context of the strengths and limitations of the data. The behavioral nature of my public response measures offers an important complement to traditional, survey-based research designs. However, this advantage is offset somewhat by limited demographic information on town residents. Besides the inherent challenges that observational, cross-sectional datasets present to causal inference, the present study also lacks several covariates that would have improved statistical control. Nonetheless, the available variables provide a rich, multivariate description of opponents and supporters of hydraulic fracturing, and indeed unprecedented in the context of a behavioral measure of public response. One goal of this study is to encourage greater use of behavioral indicators among researchers of public response. In introducing a procedure for matching records across four distinct administrative datasets, this study takes one

important step in that direction. In the future, researchers might innovate on this approach, including combining the approach with a survey.

Finally, in using the property tax assessment rolls to define the study population, I excluded opinions expressed by residents who were not landowners as well as opinions of non-residents. Landowners made up over eighty percent of all public participants, so the analysis includes the major group of participants and one that has the most at stake materially. For a more complete picture of political mobilization, future research should also examine the participation of residents who do not own land. This includes more temporary residents who do not put down roots as well as the more marginal populations who cannot afford to become homeowners. Reports from the Pennsylvania gas drilling boom indicate that renters experienced significant financial burdens and housing uncertainty as rents increased dramatically in response to the influx of temporary gas industry workers (Williamson and Kolb 2011). Finally, other speakers excluded from the analysis presented here were representatives of interest groups. This includes, on the one hand, environmental group leaders that advocated for local fracking bans and, on the other hand, gas industry representatives. Participation by these non-residents lies outside the present article's focus on participation by those with vested material stake in the debate, but a full account of what drives community siting decisions must also consider the potentially outsized influence of such outside groups.

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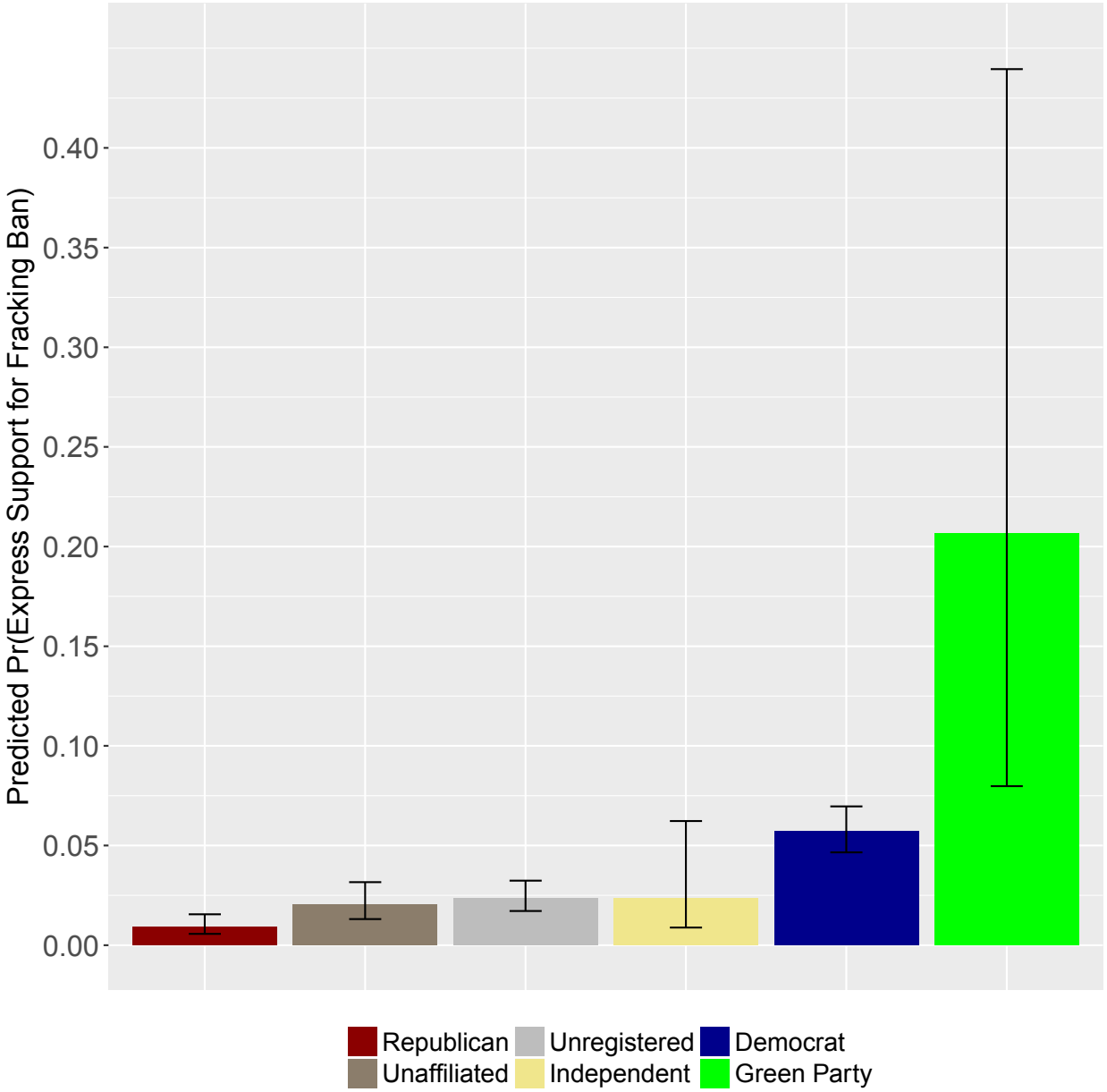
**SUPPLEMENTARY MATERIALS**




SM Figure 1. Predicted probabilities of mobilizing in support of the fracking ban by party affiliation, including all affiliation categories. Values for other variables are as follows: gas lease = 0; Ln(acres of land) = .75 (mean); residential property = 0; Investment = $140,316 (mean). 95% confidence intervals shown.

**Public Discussion of Impacts of Shale Gas Development Varies Across Space and with Proximity to Development: Evidence from a Computational Text Analysis of Public Comments in New York State**


## ABSTRACT

The study analyzes thousands of individually authored public comments submitted in the context of a contentious regulatory review of shale gas development in New York State to examine the set of concerns that residents expressed about the proposed development and the geographic distribution of those concerns. After documenting the prevalence of different topics of concern, we show that the topics have unique geographic signatures. Many topics concentrated in comments from individuals who live near proposed development and were largely ignored by individuals who lived far away. Several topics had the opposite geographic signature, concentrating in comments from residents who live far away from development. Beyond this proximity effect, geographic clustering of specific topics suggests the presence of regional, place-based effects on how shale gas development was understood by local residents. We emphasize the importance of considering the multiple social bases that underlie opposition and support for energy development.

## INTRODUCTION

The relationship between proximity to industrial projects and public response to them has been a core concern for social scientists for decades. Yet, the growing body of empirical evidence has not provided much clarity. The level of inconsistency in existing findings is striking. In a selection of recent studies, a reader will find that proximity and opposition have a positive relationship (Esaiasson 2014), negative relationship (Boudet et al. 2016), curvilinear relationship (Jenkins-Smith et al. 2011), and no relationship (Michaud et al. 2008). Additional empirical results documenting one or another relationship will not reconcile this inconsistency. It is increasingly clear that proximity confounds a multitude of social processes (Evensen and Stedman 2016). People oppose and support industrial projects for different reasons. To the extent that these reasons vary systematically across space, unpacking their heterogeneity is an important step toward a clearer understanding of public response and may help to reconcile the inconsistent empirical findings about proximity and opposition/support.

This study examines how New York residents responded to proposed shale gas development (SGD), a controversial industry that evoked significant public debate and was ultimately stayed in the state. We analyze the heterogeneity of concerns that the public expressed about shale gas development and how expression of different concerns varied geographically across the state, especially in relation to the region in the state where SGD was going to concentrate. New data and methodological tools permit an analysis that is unprecedented in empirical depth. Specifically, we introduce public comments as a new source of data for measuring public response. Public comments offer three specific advantages for this type of research: (1) they offer a behavioral measure of opposition and support of an industry, (2) they are geocoded, allowing for precise measurement of individuals' proximity to proposed

development and (3) the text of the public comments gives rich insight into the complex conceptions of industry impacts among thousands of individuals. To analyze a set of over 8,000 public comments, we introduce computational tools developed in computer science for deriving meaning from large corpora of text.

## GEOGRAPHY AND PUBLIC RESPONSE TO SHALE GAS DEVELOPMENT

Enabled by innovations in hydraulic fracturing ("fracking"), shale gas development (SGD) has reinvigorated the domestic fossil fuel industry in the U.S. over the last decade. Specifically, innovations in horizontal drilling and fluid mechanics have enabled gas companies to extract gas from "source rock," something that was previously not seen as feasible (Sernovitz 2016). These innovations have opened new development opportunities, most notably in shale rock formations, including the Marcellus and Utica formations, which stretch across much of the Northeastern United States (Wilber 2012).

Concerns about the environmental, economic, and social impacts have accompanied the rapid pace of gas and oil development that hydraulic fracturing has ignited. Qualitative studies document a variety of concerns among local stakeholders. Key concerns include potential threats to public health, environmental concerns, and quality of life issues (Anderson and Theodori 2009; Evensen and Stedman 2016; Jacquet 2014). Local informants also report positive impacts in their communities, mostly pertaining to the economic benefits in the form of local tax revenue, increases in employment opportunities and incomes, and multiplier effects in the local economy (Anderson and Theodori 2009; Brasier et al. 2011). Thomas et al. (2017) also find that respondents connect shale gas development to broader issues of climate change when considering the costs and energy independence when considering the potential benefits.

Existing survey research identifies several consistent predictors of opposition and support for hydraulic fracturing and shale gas development, including several demographic variables, education, and political ideology or identity (Boudet et al. 2013; Davis and Fisk 2014). In addition to nationally representative surveys, researchers have examined public response at more granular levels, in areas most impacted by SGD. Such studies reveal multiple and competing perceptions of risks and benefits from industry development (Brasier et al., 2011; Jacquet 2012; Schafft, Borlu, and Glenna 2013).

But so far we have only limited knowledge about how perceptions of controversial energy industries, like SGD, vary across space. Some existing results suggest space is a critical source of variation in perceptions of SGD impacts. Howell et al. (2017), use multi-level analysis to show that predictors of attitudes toward hydraulic fracturing differ by state. Boudet and colleagues (2017) combine survey data with high-resolution information on well locations and find that proximity to new oil and gas wells is associated with greater familiarity and predicts greater support for hydraulic fracturing. Evensen and Stedman (2016) identify variation in perceptions of shale gas development across different geographic scales: national, state, and local. They find that concrete beliefs about the impacts of development are more predictive of respondents' attitudes toward shale gas development in local samples than in the national sample.

Existing research also offers several reasons to expect variation across space. One fruitful line of research applies construal level theory (CLT) to explain prominent differences between how individuals who are physically proximate to development and individuals who are far away form their attitudes (e.g., Clarke et al. 2016; Evensen and Stedman 2016). To the degree that physical proximity maps onto psychological closeness, CLT suggests that individuals consider

proximate objects in more concrete and detailed terms. By contrast, individuals use more abstract mental processes to consider distant objects (Trope and Liberman 2010). For instance, Clarke and colleagues (2016) find that respondents living at greater distances from existing hydraulic fracturing projects were more likely to rely on political ideology, an abstract heuristic, to form opinions than respondents living closer to the projects. The more proximate respondents presumably considered the impacts in greater detail, and thus relied on this more concrete basis of information to form their attitudes. Gravelle and Lachapelle (2015) find a similar pattern in a study of attitudes toward the Keystone XL pipeline.

Beyond the cognitive processes at play, the information environments will differ with distance from an industrial project. The issue of development is more salient for more proximate individuals (Boudet et al. 2017). It is the subject of local newspaper coverage (Evensen, Clarke, and Stedman 2014) and garners attention in informal discussions among neighbors (Jerolmack and Walker 2016). By contrast, individuals who are far away from proposed development might only learn about the issue from national media (Mazur 2016; Michaud et al. 2008; Vasi et al. 2015), which emphasizes different aspects of the debate and may politicize it by situating it in the context of national partisan debates (Dokshin 2016; Mazur 2016).

Finally, a long line of research on place-based attitudes suggests that unique features of community context can shape perceptions in critical ways. The same project may be perceived very differently in two communities due to historical legacies and alternative definitions of place (Devine-Wright 2009; Molotch et al. 2001). For instance, communities with a legacy of industrial development tend to be more likely to view new projects positively (Wright and Boudet 2012). Other communities' sense of place excludes extractive industries and these are more likely to view proposed industrial development as incompatible (Devine-Wright 2009).

Thus, researchers recognize that people have different concerns about SGD (and energy industries in general), but there has been relatively little effort to systematically examine how such different emphases or conceptions of the industry vary in a population and, more specifically, how they relate to key explanatory constructs, such as proximity and place. This article introduces new data and new methodological tools that help fill this research gap.

## ANALYTIC PLAN: MEASUREMENT AND METHODS

We have learned a great deal about public perceptions of industrial siting from extensive survey research on the subject, but survey research also has some significant limitations that the present study aims to overcome. On a conceptual level, this study follows a tradition in social movements research of treating public opinion as "the relative prominence of different frames as predispositions in the population" (Gamson 2004:245). Specifically, we analyze the trace data of thousands of real-world expressions of opinion about SGD among people who register their views on the subject during a public comment period.

This approach shares familiarity with deliberative approaches to studying public opinion, which seek to unpack the social discourses that underlie public attitudes through open-ended discussion of an issue (Gamson 1992; Thomas et al. 2017). Deliberative approaches, however, tend to rely on small focus groups and thus trade away representativeness and generalizability for depth of analysis. Our approach avoids this tradeoff and strikes a unique balance. On the one hand, respondents frame the issue themselves in individually composed public comments, unmediated by the researcher. On the other hand, our large-N approach represents the opinions of the thousands of individuals who voluntarily decided that the issue is worth forming an opinion about, took steps to gather information about the issue, and expressed it publicly. These

individuals are not representative of the population in a statistical sense, but they represent the "public" in a classic and, arguably, more ontologically coherent sense of a deliberative and engaged citizenry (Perrin and McFarland 2011).

Critically, by examining the alternative ways that individuals frame the issue of hydraulic fracturing, we can examine the hetereogeneity of beliefs that a Likert-type survey scale would conceal. Two respondents may both report that they are "Extremely opposed" to shale gas development, for instance, but their opposition may reflect different reasons. Examining how individuals frame the issue in a personally composed comment allows us to unpack these alternative reasons. Survey researchers have sometimes attempted to gauge this heterogeneity directly by asking respondents to evaluate multiple statements (e.g., Evensen and Stedman 2016). However, this approach places a lot of burden on the researcher to select an appropriate and exhaustive list of possible questions. The approach we adopt in this study obviates this pre-selection step by learning the prominent themes from the comments inductively using an unsupervised machine learning approach.

*Public Comments Data*

The primary data for this study consist of public comments that the New York State Department of Environmental Conservation (DEC) received in response to their regulatory review of hydraulic fracturing. Specifically, the DEC was tasked with reviewing regulatory challenges associated with SGD and drafting a Supplementary Generic Environmental Impact Statement (SGEIS) that would provide guidance for issuing well permits for SGD. Because adoptions of the proposed rule changes in the draft SGEIS would ultimately open the door to SGD in New York, the public comment period emerged as a focal point for debate over whether to allow SGD

in the state. New York's review began in November 2008 and went through four rounds, with the last round ending in January 2013. We obtained digital copies of all comments submitted during the review process from the NYSDEC by filing a Freedom of Information Law request. Unfortunately, not all comments are in a format amenable to analysis. For many of the comments submitted through regular mail, including all hand-written comments, it would be cost- and time-prohibitive to extract commenter information. We limit the analysis to the third round of review (September 2011-January 2012) and to comments that were submitted electronically or that were successfully scanned using optimal character recognition software by the DEC. We additional limit our analysis to comments that had at least 50 words. This set includes 20,082 individual public comments.

Not all comments are equally informative of people's personal opinions. Public comment periods are commonly targeted by advocacy organizations with submissions of auto-generated comments (Dokshin and Buday 2017). Although it is meaningful that a person may choose to endorse a prepared statement by an organization, such comments are not representative of the opinion-formation process that we are interested in here. Therefore, we want to limit our focus to comments that were composed individually. To filter out auto-generated comments, we used plagiarism detection software to identify overlapping content among the 20,082 comments. For each comment, we identify the highest pairwise plagiarism score, which signifies the percent of the comment's content that appears verbatim in another comment. Figure 1 displays the distribution of the maximum pairwise plagiarism scores for all of the comments in the corpus. The distribution is bimodal, with the majority of comments being either entirely original in composition (left side of the histogram) or complete facsimiles of at least one other comment in the corpus (right side of the histogram). There is some level of redundant content that may

happen by chance, especially among comments that pertain to the same issue. Allowing up to 20% redundant content, we retain 8,251 individually composed public comments for the textual analysis. Some of these comments were submitted by individuals living outside of New York State and some did not contain sufficient information to geolocate the participants. Thus, while the text analysis is based on the entire corpus of 8,251 comments, the spatial analyses presented below use the 6,992 geolocated comments.

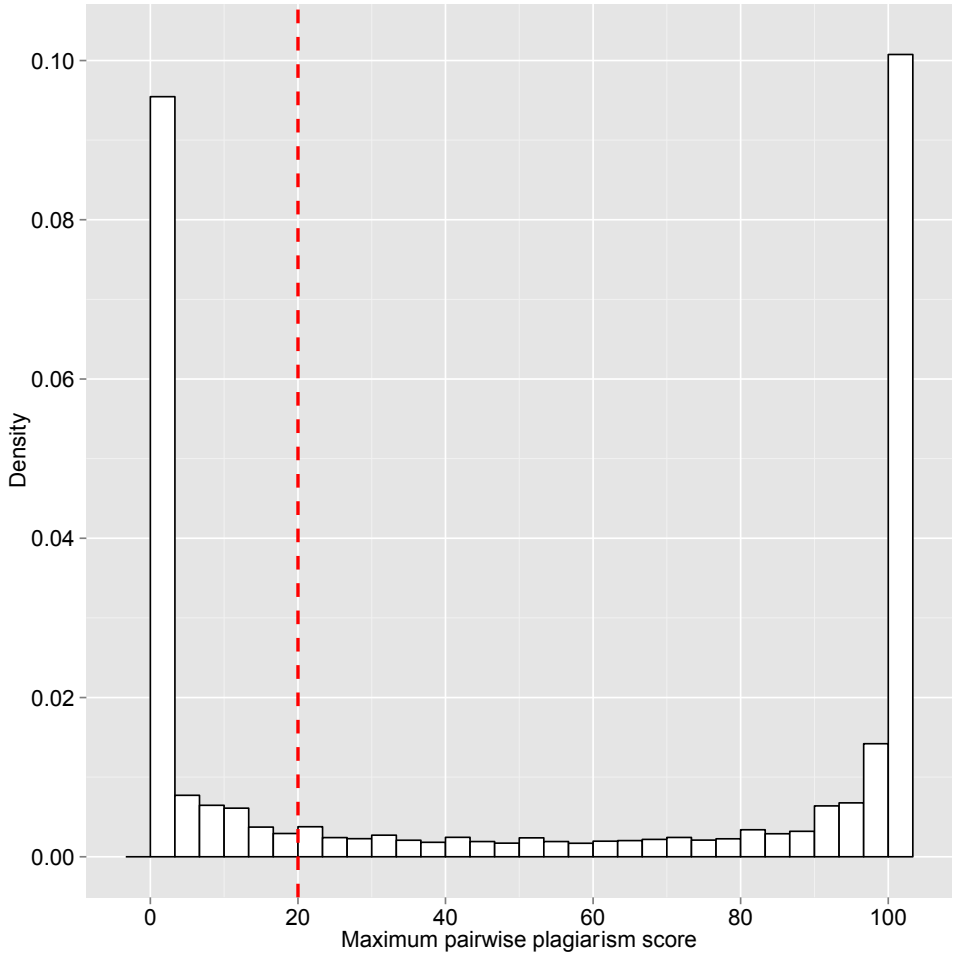



Figure 1. Distribution of pairwise plagiarism scores among 20,082 public comments.

*Methods*

To examine this large corpus of public comments, the study uses topic modeling, an unsupervised machine learning technique for discovering latent themes in large sets of documents (Blei 2012). A topic model iteratively samples the documents and identifies words and phrases that cohere into "topics" across the population of documents. Each document is composed of a mixture of the discovered topics. The approach has been shown to identify meaningful topics across a variety of document types, including in political text (Farrell 2016; Roberts et al. 2014). Topic modeling allows us to code a corpus of many thousands of documents—a task that would be cost prohibitive with traditional, manual methods. Another feature of topic modeling is that it does not presuppose the set of topics, but finds them inductively, independent of any preconceptions the researcher may hold. As with all approaches to content analysis, topic model results require interpretation by a knowledgeable researcher.

Topic modeling is an unsupervised machine learning approach, which means that the researcher does not need to pre-define categories or train the model with human-coded content. The single critical analytical decision that the researcher makes is the number of topics for the model to estimate. There is no "correct" choice about the number of topics (Farrell 2016). More topics will result in finer-grained distinctions and fewer topics will generate coarser categories. The decision about how many topics to estimate should be determined by the goals of the analysis, the researchers' deep understanding of the corpus, and a recursive interpretation of model results based on prior findings (Farrell 2016). In our case, this procedure leads us to select a 33-topic solution. Numbers above 33 yielded diminishing returns in terms of meaningful partitions of topics, whereas fewer than 33 topics did not make some meaningful partitions. This solution also minimized the number of "throw away" topics—partitions that are artifactual to the

statistical procedure. Six such "throw away" topics were generated and are excluded from the results presented below.

We used a series of common pre-processing steps to prepare the text for analysis. We excluded all whitespace, punctuation, and numbers. We also converted all text to lower case, removed "stop words" (the most common English words), and applied the Porter algorithm to reduce words to their common root (e.g., substituting "contamin" for "contamination" and "contaminated").

After estimating the topic model, the analysis proceeds as follows. First, we examine the distribution of comments across the state. Did the debate about SGD concentrate in the potentially impacted counties in upstate New York or was participation geographically diffuse? Second, we examine the set of discovered topics, their relative prevalence, and how the topics relate to each other. Third, we examine whether the substance of the debate varied geographically in a systematic way. Is there an even distribution of topics across the state, or did some topics garner greater attention in communities proximate to development while other topics dominated discourse in distant places? For this purpose, we calculate the distance of the origin of each submitted comment to the nearest of the 62 fracking well applications that were on file with the DEC by the start of the comment period. Finally, we explore the spatial contingency of discourse about SGD with greater nuance by presenting key contrasts on a map of New York State.

**RESULTS**

Figure 2 displays the geographic distribution of the 6,992 geocoded public comments across New York counties. The size of the circle represents the absolute number of comments submitted

from that county and the shading represents the rate of comment submission per 10,000 county residents. New York residents from across the state participated in the comment period. The participation was more intensive in the counties that lie atop the targeted Marcellus Shale formation, in upstate New York. In absolute terms, however, a large fraction of comments came from New York City, the surrounding suburbs, and several large metro-areas that did not expect development. The pattern of participation is consistent with recent findings that concern over hydraulic fracturing was not just a NIMBY phenomenon, but also spread among citizens that were removed from direct impacts (Clarke et al. 2016; Dokshin 2016).

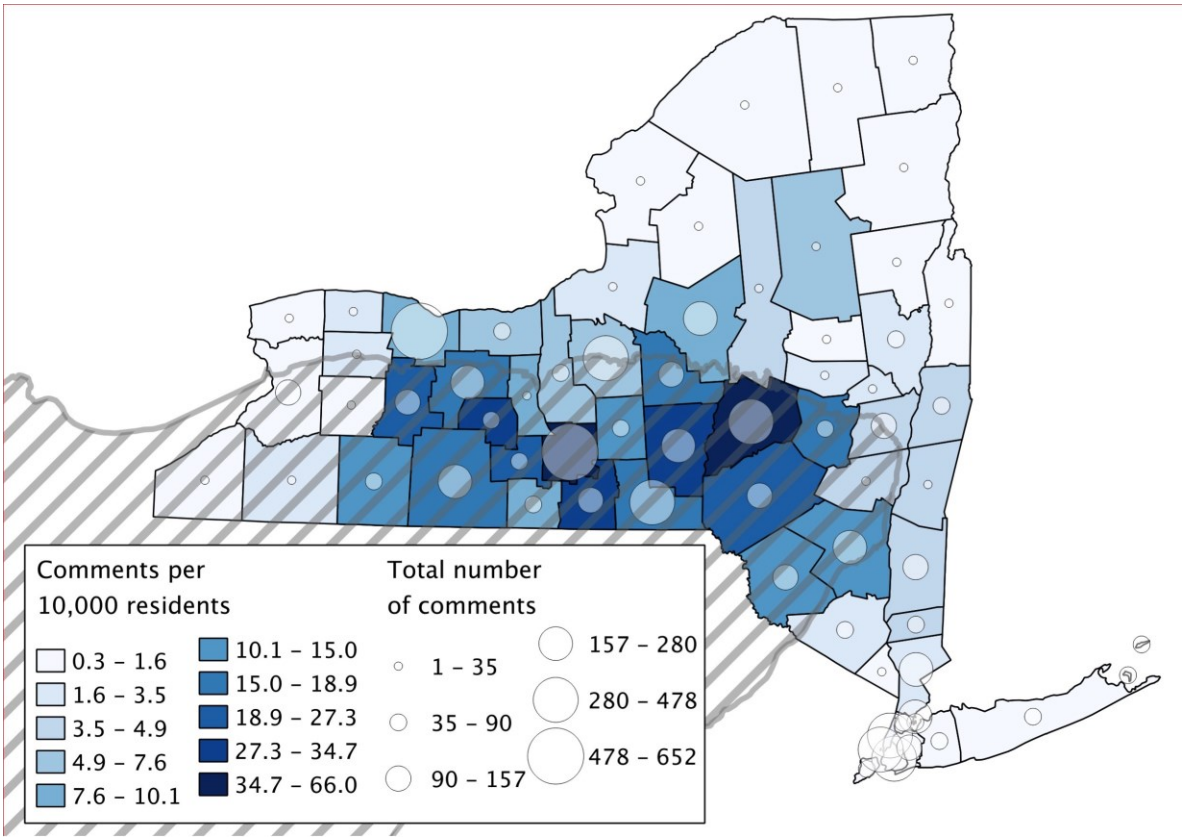


Figure 2. Geographic distribution of public comments included in the analysis by county.

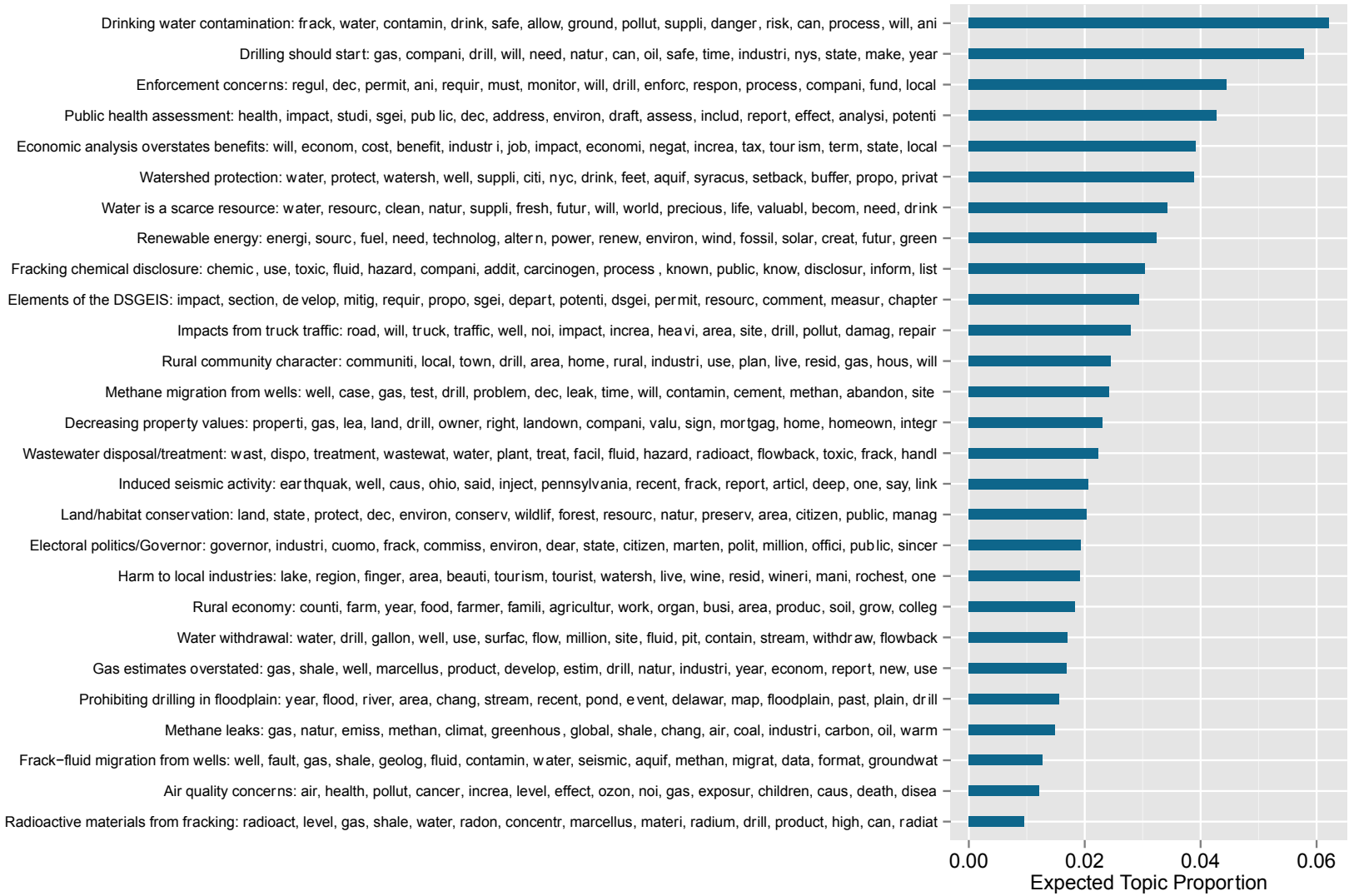



Figure 3. Topics results from a 33-topic model fit to 8,251 public comments, including topic label and top 15 words associated with each topic. Expected topic proportions indicate the prevalence of the topic in the entire corpus of comments.

Figure 3 provides a summary of the most prevalent topics, alongside a list of the top 15 most common words associated with the topic. To label the topics, we read 50 top comments associated with each topic. For most topics, the top 15 words make the subject of the topic unmistakable. A few topics are less clear from the words alone, but upon reading the top-scoring comments for the topic one quickly converges on the main subject.

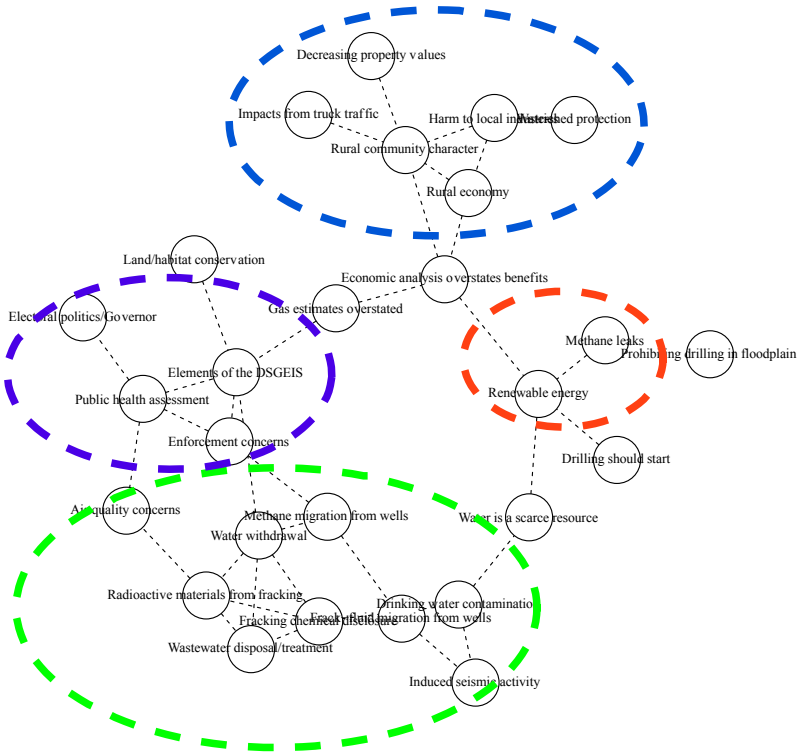



Figure 4. Network of positive correlations between topics of the 33-topic model. A tie between two topics indicate a significant positive correlation between the two topics. The network is graphed using the Fruchterman-Reingold algorithm. Colored circles indicate distinct clusters.

New York residents raised a variety of concerns about SGD in their public comments, many of which have been identified in previous studies of public perceptions about hydraulic fracturing impacts. Broadly, the public focused on concerns about adverse impacts on water, discussed a number of local impacts, presented alternative views on the economic benefits of SGD, and connected SGD to broader issues like climate change and renewable energy. A few topics focus more narrowly on the proposed rules and assessments in the draft SGEIS.

A single comment may attend to several substantive topics. Writing about two topics in the same comment suggests that the author sees the two topics as related. We can exploit this relational feature to examine how topics relate to each other in the entire corpus. Figure 4 plots the layout of a network in which two topics are placed closer when they are more likely to appear together in the same public comment. We overlay circles around several thematic clusters. The first cluster, marked in green at the bottom of the figure, focuses on scientific and technical disputes about the risks associated with various stages of SGD. The second largest cluster, in blue at the top of the figure, includes local concerns about SGD. The purple cluster on the left side of the figure includes topics about governance—discussing elements of the proposed document (Draft SGEIS), its failure to include a public health assessment, concerns about enforcement, and the politics of the DEC (an agency under the authority of the New York governor's office). We highlight a final pair of topics, consisting of two topics that connect SGD to the issue of climate change (highlighted in red).

| | |
|---|---|
| I'm a landowner in Tioga County. I feel that gas drilling can be done safely under the regulations of the DEC. The drilling will bring thousands of new jobs into NYS along with much money which will ease the burden of NYS taxpayers. It is the shot in the arm which NYS sorely needs. | New York needs gas drilling and we need it now! The rdSGEIS has been studied, reworked and rewritten for almost 4 years. Let's move forward. Regardless of what opponents say, it has been proven that gas drilling can be done safely and responsibly without harm to people and the environment. Gas companies are still willing to give NY a chance, but they are also getting impatient with the delays. The rdSGEIS has already put into place more thorough and stringent drilling regulations than any other state in the country. It may not be perfect, but it could be "tweaked" as we go forward and learn more as drilling progresses. If we miss this opportunity for economic benefit, it may be a long time before it comes our way again. Drill now! |

Figure 5. Top two comments by proportion of "Drilling should start" topic.

One topic that did not fit into a cluster is especially worth highlighting: "Drilling should start." This topic is dominant in comments by gas drilling advocates who emphasize the economic benefits from the gas industry and urge the DEC to begin issuing drilling permits. Two comments that are most associated with this topic are printed in Figure 5. It may seem odd that this topic is correlated with the "Renewable energy" topic in Figure 4. While this topic does a good job of capturing consistently pro-drilling attitudes in comments with a high proportion of the topic, the topic also appears in comments that talk about benefits from development disproportionately accruing to the gas companies themselves, not local communities. An

alternative title for the topic might be "Distribution of benefits from the gas industry." Because the mass of the topic concentrates in pro-drilling comments, its prevalence in local discourse is a valid indicator of the presence of local support for drilling, which is why we chose the label "Drilling should start." However, the nuance is important to clarify. To validate our interpretation, we manually coded the 50 top-scoring comments on this topic and found 38 that unequivocally endorsed SGD.

Did the concerns that New Yorkers raise in public comments vary geographically? As an initial test, we regress topic proportions on distance to the nearest proposed hydraulic fracturing well in New York State. The linear fits between distance and topic proportion are plotted in Figure 6 and include 95% confidence intervals. The lines represent the unique "geographic signature" of each topic. Slopes that deviate from zero indicate that the topic's prevalence in the debate was not distributed evenly across New York. A negative slope indicates that the topic was more likely to be invoked in comments written by New Yorkers living near proposed development, and a positive slope indicates that the topic was more likely to be invoked in comments written by New Yorkers living far away from a proposed well. We present the plots in ascending order of the effect of distance on topic proportion, from smallest (most negative) to largest (most positive).

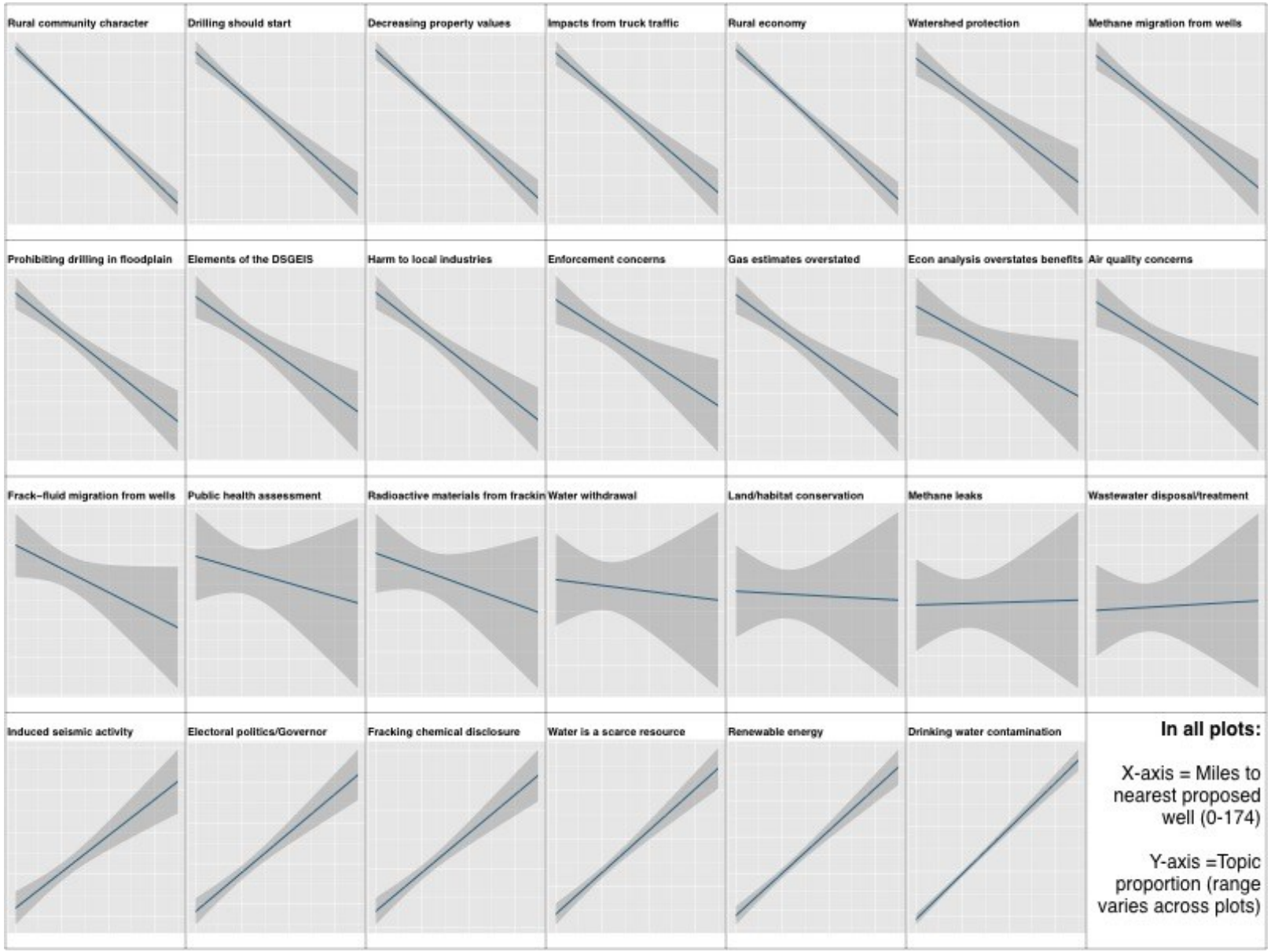



Figure 6. Linear regression fits of the relationship between topic proportion (Y-axis) and distance to the nearest proposed hydraulic fracturing well (X-axis).

Flat slopes are a rare exception in Figure 6, indicating that the social discourse around SGD varied substantially with proximity to proposed development. Proportions of most topics have a negative relationship with distance to the nearest proposed well. This suggests that the majority of the topics were discussed with greater frequency in communities near proposed development relative to communities farther away. Topics that pertain to local impacts of SGD have the steepest negative slopes. For example, the steepest negative relationship is between distance to a proposed gas well and discussions of "Rural community character" (top left panel). Similarly, the volumes of discussion of "Decreasing property values", "Impacts from truck traffic", and "Rural economy" have strong negative relationships with distance from a proposed well. Indeed, discussions of all of the topics in the blue, "local impacts" cluster from Figure 4 have a strong, negative relationship with distance to a proposed gas well. As we move across the plots to examine less negative relationships, we encounter a mix of topics from the green, "scientific debates" cluster and the purple, governance cluster.

Another notable topic with a strong negative relationship with distance is the one most associated with gas drilling support, "Drilling should start." This is consistent with recent findings of a "Yes in my backyard" (YIMBY) pattern in response to hydraulic fracturing—individuals living closest to gas development are more likely to support it (Boudet et al. 2017).

In general, the plots in Figure 6 suggest that debates about SGD were deeper and more multi-faceted in communities that were nearer proposed gas wells. Many of the topics were discussed by residents in close proximity to proposed development, while being largely ignored by the more distant public comment participants. Distant participants' discussions concentrated on fewer topics. Just six topics had strong, positive relationships with distance to the nearest

well, indicating that they garnered greater attention among public comment participants who live far from the proposed development region. These include two topics about SGD's impacts on water sources, a topic on increased incidence of earthquakes, which has been linked to SGD, a topic on the need for disclosure of the chemicals used in hydraulic fracturing, a topic discussing alternative, renewable energy sources, and a topic about electoral politics.

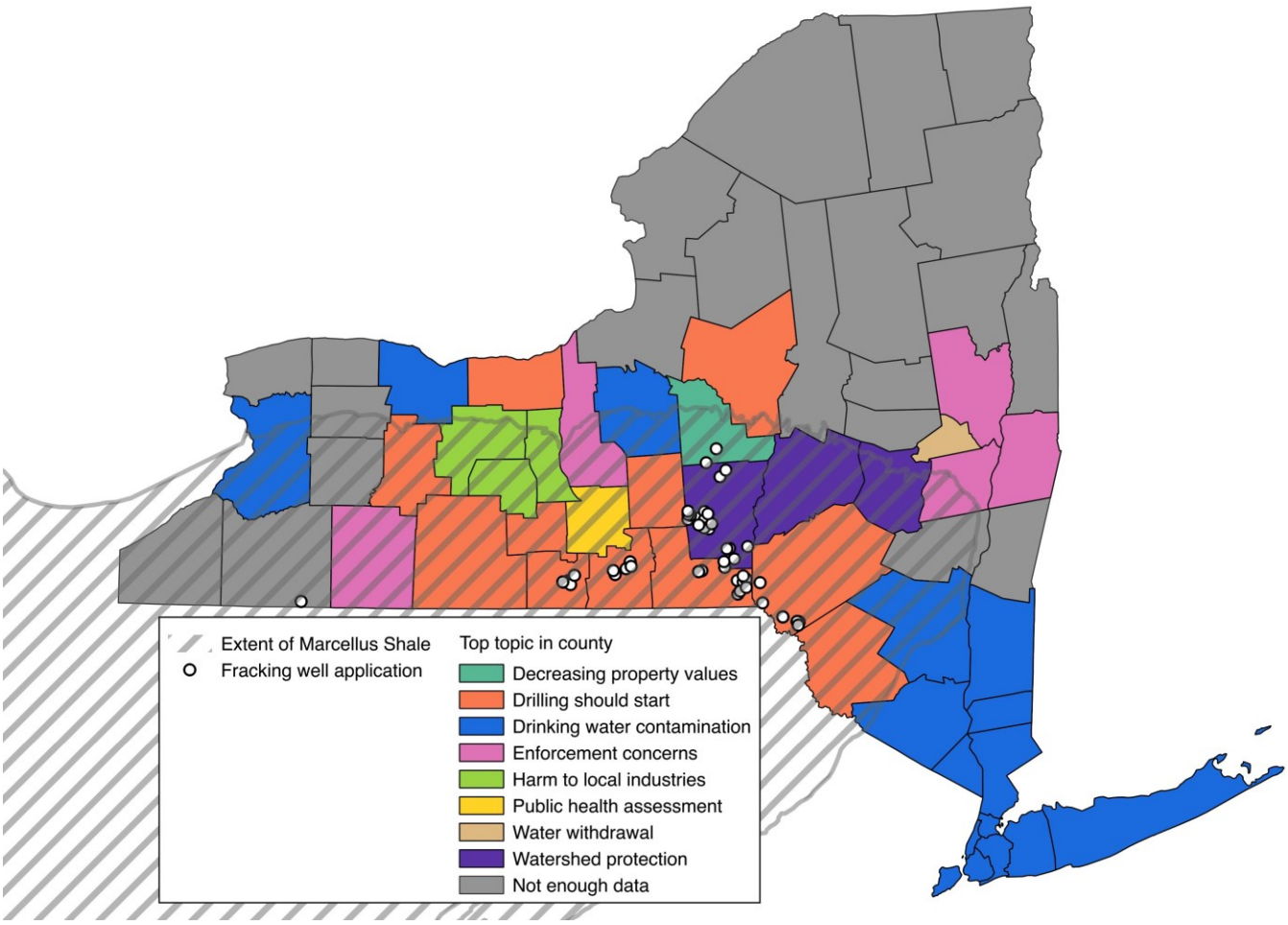



Figure 7. Top topic of discussion in New York counties by average proportion of all public comments that originated from each county. Counties with fewer than 30 comments are omitted to reduce noise.

The emphasis on proximity to proposed industrial sites is central in literature on public response, but a linear relationship between attitudes and distance is not the only possibility worth

exploring. As Evensen and Stedman (2016) write, social discourse about energy development is shaped by local social contexts in myriad ways, including by place-based identities and historical legacies. In the final stage of the analysis, we take an initial step to examine how the social discourse surrounding SGD might be conditioned by place. Rather than looking at the general tendency for topics to increase or decrease with proximity to development, we adopt a more flexible approach, using maps to examine how social discourse about SGD clusters in space. As an initial cut, Figure 7 displays a map of New York State with each county colored based on the most prevalent topic among comments that originated from that county. To reduce biased estimates due to sparsity, we exclude counties with fewer than 30 comments.

There are several noteworthy patterns in Figure 7. First, comments originating from New York City and surrounding suburbs are dominated by the "Drinking water contamination" topic. Second, counties along the Pennsylvania border, which have the greatest potential for SGD, invoke the pro-drilling topic at the highest rates. Third, there are two clusters of three counties each, for which place-based concerns emerge as dominant themes. In green, three counties in the Finger Lakes region of New York emphasize SGD's potential harm to local industries. This is a rural region, but it also has a vibrant tourism and wine industry, which commenters worried would be harmed by SGD. For example one comment from the region reads: "People from all over the world come to the Finger Lakes to enjoy the pristine lakes, scenic countrysides, and world-class wines.  Please help protect this beautiful region from the hazards of hydraulic fracturing." A second, purple cluster emphasizes "Watershed protection." These counties lie just outside of the New York City watershed where the proposed rules would ban SGD. The three counties' proximity to communities in the watershed that were protected from drilling appears to have heightened a sense of injustice among their residents. As one top-scoring comment on this

topic suggests: “My well is as important to me as any public drinking supply and watersheds. […] The 2000-foot buffer should be applied to ANY water supply, including my private well.”

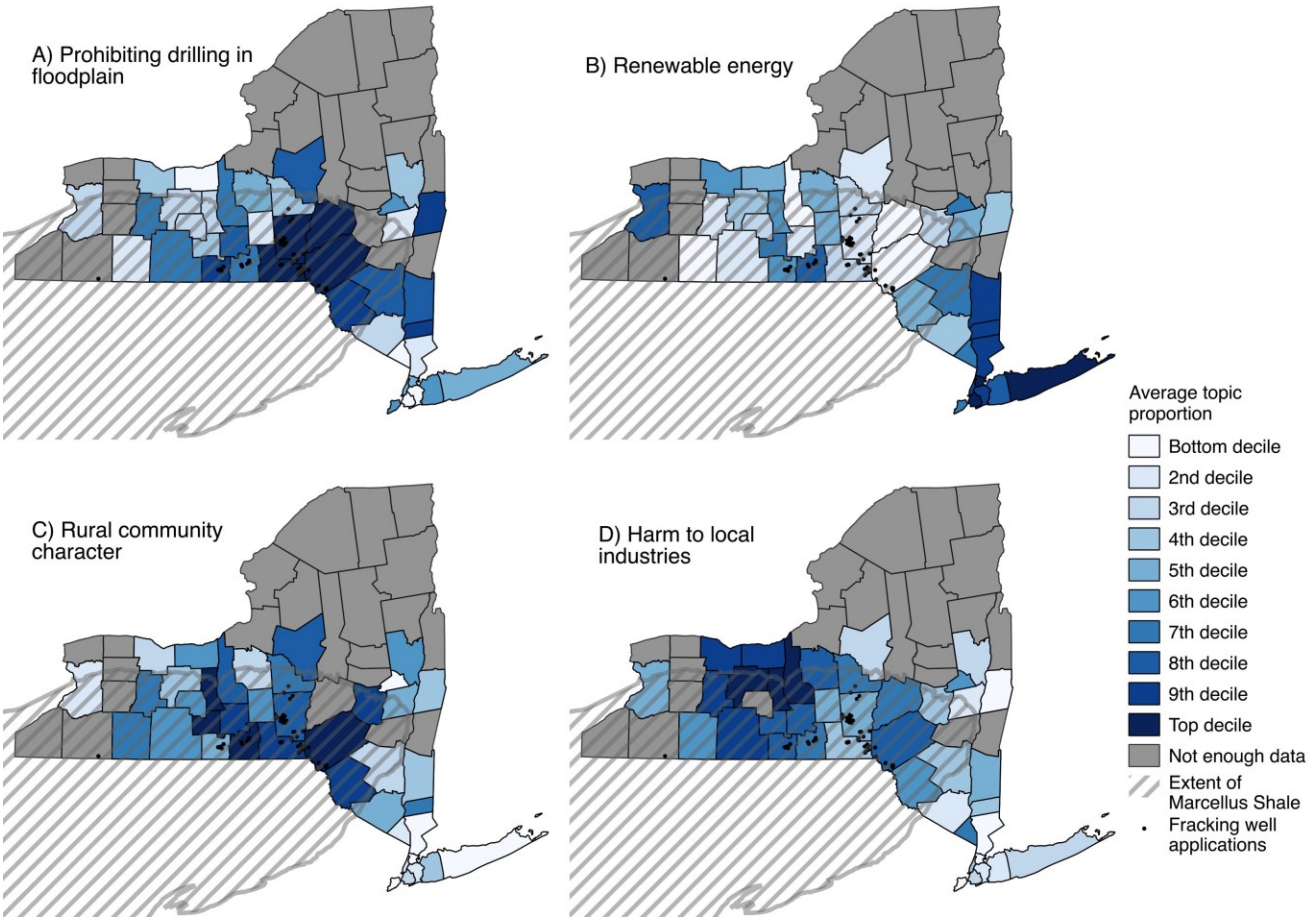



Figure 8. Average topic proportions for a selection of topics. Shading corresponds to decile category, with darker shades indicating higher average topic proportions. Counties with fewer than 30 comments are omitted to reduce noise.

Figure 8 expands the analysis beyond the top-scoring topics by plotting the county specific averages of topic proportions for a selection of topics. To facilitate comparison across plots, the shading corresponds to deciles (e.g., counties in top 10% by proportion of the topic have the darkest shade). The maps show additional evidence of place-based effects. For example, the topic “Prohibiting drilling in floodplain” forms a tight high-density geographic cluster. This topic pertains to concerns that risks from flooding should be given more consideration, primarily

because the floodplain definition that the DEC uses is outdated. The counties scoring high on this topic cluster in the region that was devastated by historic floods in 2006 and again in 2011, just prior to the comment period. The pattern suggests that the experience of flooding made the issue more salient and lead residents from the region to emphasize a risk that others were less likely to identify. A final topic I wish to draw special attention to is the "Renewable energy" topic, which concentrated primarily in New York City and the surrounding suburbs. This may be evidence of a successful "bridging frame" (Benford and Snow 2000). Connecting SGD to broader environmental concerns, like renewable energy and climate change, provides a way to scale the debate from a local one to also mobilize environmentalists across the state.

**DISCUSSION**

The study used innovative methods to explore public perceptions of SGD as expressed in thousands of comments submitted by New York residents during a high-profile public comment period and to examine how social discourse around SGD varied across space. Broadly speaking, the analysis revealed that there is significant variation in how residents from different places think about a contentious energy industry. This finding has important implications for research on public response to controversial industries. Primarily, our results draw attention to the spatial contingency of beliefs and perceptions about contentious industries. It suggests, for example, that two strong opponents of SGD, one who lives near proposed development and one who does not, may have little in common in terms of the reasons for their strong opposition. Beyond the influence of proximity, the analysis shows that discourse about SGD is organized regionally, providing important support for theories that emphasize the importance of place for risk perception. Future explanations of public response should consider this important heterogeneity.

The findings may help reconcile the inconsistent results pertaining to the relationship between proximity and opposition to industrial sites. Rather than measuring an overarching relationship between opposition and distance to development, it may be more meaningful to ask how different frames vary across space. Frames relate to each other and can have positive or negative valence (i.e., they are associated with either support or opposition to the industry). Frames that resonate under a particular set of local conditions form a bundle and provide a basis for a unique constituency. Previous research tends to focus on the average relationship between opposition and distance (negative, positive, zero, or curvilinear), but perhaps a better way to think about public response is as the mobilization of these alternative constituency, each having a unique geographic basis. Most generally, NIMBY (Not in my backyard) and YIMBY (Yes in my backyard) constituencies emphasize local impacts, negative and positive, respectively; whereas a NIABY (Not in anyone's backyard) constituency emphasizes more abstract concerns. The relative mobilization of each constituency in a given episode will determine the average effect of distance on opposition/support.

The current study is largely descriptive—documenting the set of frames and their variation across space—but researchers should ultimately seek to understand the structural and social conditions that give rise to these alternative accounts. Previous research suggests the importance of objective risks and benefits, local history, and place identities for local perceptions of industrial development. Less research has examined the conditions that evoke mobilization by conscience constituents (i.e., individuals not directly impacted by the proposed development). To this end, it is instructive to more closely examine the set of topics that characterized the social discourse of distant opponents of SGD.

What do these topics have in common? One common thread may be extensive coverage in national media. Debates about SGD unfolded earlier in the likely development region and the local impacts were fleshed out in local newspaper accounts and in town halls (Dokshin 2016; Evensen Clarke, and Stedman 2014). The broader public remained largely unaware of SGD, with 52% of a nationally representative sample claiming to not have heard anything about "hydraulic fracturing" as late as 2012 (Boudet et al. 2013). Attention to SGD expanded rapidly, however, precipitated by the success of *Gasland*, a documentary film about fracking, and the investigative series by *The New York Times* and *ProPublica*, which attracted significant attention (Mazur 2016; Vasi et al. 2015). Vasi et al. (2015) show that *Gasland* was instrumental in linking SGD with water contamination in the minds of the general public. National coverage also emphasized risk of contamination by chemicals found fracking fluid and induced seismic activity, two topics that our analysis finds to be relatively more prevalent in communities farther away from actual development.

Additionally, it also likely that the social channels that mobilized people in communities more proximate to development were different from those that mobilized people in distant communities. In an analysis of a public comment period in Illinois, Dokshin and Buday (2017) also find that many comments about proposed hydraulic fracturing regulations originated in parts of the state far removed from prospective drilling. Using information on participants' organizational affiliations, they find that these "conscience constituents" were disproportionately recruited by large, progressive organizations, including 350.org, CREDO Action, and the Sierra Club. If a similar process unfolded in New York, we might expect that SGD opponents from distant communities are more likely to be progressive or environmental activists, compared to opponents from the targeted region, who probably include concerned residents without strong

ideological commitments. This interpretation is bolstered by the concentration of the "Renewable energy" topic in New York City and its suburbs (Figure 8).

Finally, this article introduces a new source of data and a methodology for analyzing it—innovations that will help move research on public response forward. Public comment periods serve as focal points of policy debates at every level of government in the United States and elicit millions of individual expressions of opinion. These are untapped data sources for examining not only questions about public responses to industrial projects, but more generally theories of collective action, policy formation, democratic participation, and opinion dynamics. Future research should expand on the analyses presented here to include additional explanatory variables. Additionally, much can be learned from comparative analyses of public response across different social contexts and different types of industries.

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