Voters and Donors: The Unequal Political Consequences of Fracking

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Over the last 15 years, the shale gas boom has transformed the US energy industry and numerous local communities. Political representatives from fracking areas have become more conservative, yet whether this elite shift reflects mass preferences is unclear. We examine the effects of fracking on the political participation of voters and donors in boom areas. While voters benefit from higher wages and employment, other fracking-induced community changes may dampen their participation. In contrast, donors experience more of the economic gains without the negative externalities. Combining zip code–level data on shale gas wells with individual data on political participation, we find that fracking lowers voter participation and increases donations. Both of these effects vary in ways that benefit conservatives and Republicans. These findings help explain why Republican candidates win more elections and become more conservative in fracking areas. Our results show broadly positive economic changes can have unequal political impacts.

Over the last 15 years, the technological innovation known as "fracking" has created an oil and natural gas boom, transforming many areas of the United States. Anecdotal evidence is abundant. For example, fracking elevated the inhabitants of the small town of Cotulla, Texas, from near poverty to wealth overnight. Nearly every student in the community's elementary schools now has an iPad, students ride to school in brand new buses, and parents are no longer required to subsidize the cost of school supplies (Chumley 2014). Systematic studies show fracking has significant consequences for labor markets and local economies: Feyrer, Mansur, and Sacerdote (2017) estimate that $1 million of oil and gas production increases average wages in a county by $35,000.

With the immense changes it has brought—both to the energy sector writ large and to small communities like Cotulla—fracking is likely to have significant consequences for American politics; indeed, issues of fracking were prominently featured in presidential primary and general election debates in 2020 (Pike 2020). A burgeoning literature examines this potential political impact. Cooper, Kim, and Urpelainen (2018) find that fracking brings an electoral advantage to Republican candidates and that, when these candidates are elected, they are less likely to vote for environmental protection. Fedaseyeu, Gilje, and Strahan (2018) find that support for Republican candidates in presidential, congressional, and state gubernatorial elections increases sharply after fracking. They also find that members of Congress from shale-producing districts and states become more conservative on energy issues, as well as on civil rights and labor policy.

While existing work sheds light on fracking's impact on electoral competition and roll call votes, the impact on individual political behavior in these communities is unclear, making the existing elite-level evidence difficult to interpret. On one hand, legislators might become more conservative in these areas as a response to voter preferences: voters in boom areas become more conservative, especially on environmental issues, perhaps because they begin to link the fracking industry to their personal well-being. On the other hand, it is also possible that voters in these areas do not become more conservative, or even become more liberal, but that legislators in these areas respond to a different segment of the electorate. In this scenario, preferences might not change, but the participants do.

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Replication files are available in the *JOP* Dataverse (https://dataverse.harvard.edu/dataverse/jop). The empirical analysis has been successfully replicated by the *JOP* replication analyst. An appendix with supplementary material is available at https://doi.org/10.1086/717084.

Published online May 6, 2022.

The Journal of Politics, volume 84, number 3, July 2022. Published by The University of Chicago Press for the Southern Political Science Association. https://doi.org/10.1086/717084

The absence of evidence about fracking's participatory impacts is also surprising given the significant increase in income and wealth in fracking areas. Income and wealth are considered two of the most important predictors of individual political participation (Verba, Schlozman, and Brady 1995). Yet, fracking has also reportedly brought numerous social and demographic changes in boom communities that may decrease political engagement. For example, studies document that increased demand for labor and higher wages in fracking areas affects individuals' incentives to stay in school (Cascio and Narayan 2022). Thus, the impacts of fracking on political participation are a priori unclear.

When the fracking boom started around 2005, little attention was given to the issue, and media coverage was scant. However, as concerns about the environmental impact of fracking rose, fracking has become such a salient political issue that demand for environmental protection and conservation has increased at the local level (Healy 2015). As the controversy over fracking increased, attempts to regulate shale gas drilling followed. Especially after 2009, state governments with the main authority to regulate fracking have started to introduce bills that address issues of severance taxes and fees on drilling activities (Rabe and Hampton 2015). This could alter the calculations of energy firms and related individuals who benefit from shale gas booms in terms of their willingness to participate in politics to protect their economic interests.

We study how the shale boom has affected individuals' political participation in the form of voter participation and campaign contributions. We focus on these two outcomes because voting is the most common and least unequal form of political participation, whereas contributions are heavily dominated by wealthy individuals (Gimpel, Lee, and Kaminski 2006; Schlozman, Verba, and Brady 2012). Therefore, we can compare how resource booms affect two starkly contrasting forms of political participation. To measure a local area's exposure to the shale boom, we collect data on fracking wells at the zip code level between 1990 and 2016 and combine this information with individual-level data on participation. Using a difference-in-differences design, we find that the shale boom causes a decrease in individual's likelihood to participate in voting but an increase in donating to political campaigns. We also show that there are no diverging pretrends in voting and campaign contributions in fracking areas before the boom started, validating a key assumption of the difference-in-differences analysis, and we use instrumental variables and a within-voter design as additional checks on our main findings.

Although it is intuitive that campaign contributions increase as a result of fracking's positive shock to the local economy and incomes (Ansolabehere, de Figueiredo, and Snyder 2003), it is somewhat less intuitive that such a shock would decrease voter participation. We analyze county-level outcomes to explore potential mechanisms for our results. Additional analyses at the county level show that fracking, while leading to growth in wages and employment, also leads to drops in education and political competition, which could be labeled as "negative externalities" from fracking booms on the affected communities. Given that the effects of education on turnout are well documented (e.g., Sondheimer and Green 2010), our analysis at the county level provides plausible mechanisms behind the voting decline in fracking areas.

We also find that these effects have consistent partisan consequences: declines in voting are concentrated among liberal voters, while increases in donations are concentrated among Republican candidates. We argue that this is mainly driven by the changes in congruence between politicians and constituents. Individuals in fracking areas became more supportive of shale gas development, mainly due to their perception of positive impacts on their local economies, and this change is more salient among Democrats (Boudet et al. 2018). However, existing studies show that politicians exhibit very little change in their voting patterns on energy-related issues (Cooper et al. 2018). Republican politicians at both the federal and state levels have supported more fracking activities, whereas Democrats from fracking areas did not adjust their voting behaviors on energy issues. At the candidate level, our analysis also finds that Democratic candidates who competed in both state and federal primaries did not become more conservative after fracking booms. In contrast, Democratic candidates in state-level races became more liberal after the booms. This incongruence between the voters' preferences and the politician's position may reduce voting among liberal voters more than among conservative voters in fracking areas (Adams and Merrill 2003).

Our article complements existing studies of the shale boom's political effects (Cooper et al. 2018; Fedaseyeu et al. 2018), as well as broader research on resource booms and energy policy and politics (e.g., Haber and Menaldo 2011; Ross 2001; Stokes 2016). A large literature examines the effects of resource abundance on economic growth and political institutions (e.g., Haber and Menaldo 2011; Ross 2001). More recently, scholars have explored whether changes in wealth from resources affect corruption and the pool of candidates (Brollo et al. 2013), as well as who wins office (Carreri and Dube 2017), mostly in the context of developing countries. By exploiting zip code–level data on fracking, we demonstrate that resource booms started in the private sector can also have significant political consequences in advanced democracies. Highlighting heterogeneity in the microlevel effects of a particular resource boom, we provide insight into the broader question of how and why resource booms affect politics and policy.

Our article also contributes to the literature on local economic conditions and political participation by using individual-level data. Existing studies document that positive shocks to demands for local labor decrease voter turnout (Brunner, Ross, and Washington 2011; Charles and Stephens 2013), but these analyses are at the aggregate level. Given that local economic shocks generate migration of workers into booming areas, it is not clear whether the observed effects on participation are driven by changes in the composition of individuals in the affected areas or changes in the behavior of those already living in those areas. By incorporating the analysis of longitudinal data on individual voters and donors, we show that changes in political participation are mainly driven by individual-level changes, not by changes in who lives in fracking communities.

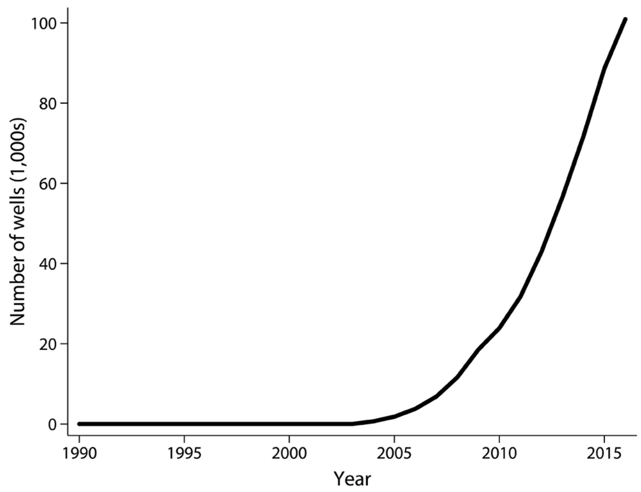

Figure 1. Horizontal gas wells in the 48 lower states (in 1,000s) by year, 1990–2016.

THE FRACKING BOOM IN THE UNITED STATES

Shale gas is natural gas produced from organic shale formations. In the United States, shale gas accounted for only 1.6% of total natural gas production in 2004, but in 2010 that number rose to 23%. Shale production is projected to increase to about half of total US gas production by 2035, with gas itself accounting for nearly 40% of energy production by 2040 (US Energy Information Administration 2017). The US government's interest in shale started in the late 1970s after a series of energy crises. The government funded R&D programs and established tax credits that incentivized private firms to invest in technologies for shale gas extraction. Before 2003, using conventional vertical drilling to extract oil and gas from shale formations was seen as infeasible. The technological innovations of hydraulic fracturing and horizontal drilling made shale gas extraction viable. Informally referred to as "fracking," hydraulic fracturing is a well development process that involves injecting water, sand, and chemicals under high pressure into a bedrock formation. This process is intended to create new fractures in the rock as well as increase the size, extent, and connectivity of existing fractures (Gold 2014). As figure 1 presents, there has been a dramatic increase in the number of fracking wells since 2004.

The shale gas boom has brought immense economic and social changes to many communities in the United States. The surge in horizontal drilling resulted in significant consequences in local labor markets. Fracking brought growth in wages and employment (Feyrer et al. 2017) and changes in property values (Muehlenbachs, Spiller, and Timmins 2015). Yet, studies also have documented numerous negative externalities produced by shale gas booms, which could affect "social capital" in communities and individuals' political engagement. Cascio and Narayan (2022) find that because of increased demand for low-skilled labor, fracking leads to lower high school completion rates among male teenagers. Kearney and Wilson (2018) document that, despite the increased wages and jobs for non-college-educated men, marriage rates did not increase in fracking areas after the boom. Media accounts also suggest that there are increases in crime in fracking areas (e.g., McKelvey 2014). James and Smith (2017) and Komarek (2018) present evidence supporting the argument that fracking is associated with an increase in crime rates, whereas Bartik et al. (2019) find limited evidence of a systematic increase in crime due to fracking.

Media reports also suggest that royalty payments are often concentrated among a small group of landowners (Cusick and Sisk 2018). This disparity could lead to increases in income inequality in the shale-affected areas. Alcohol problems in boom towns and drug trafficking on roads created for shale gas development also have been reported in the media (Healy 2016). If wage increases from shale gas booms lead individuals to allot more time to consuming drugs and alcohol, it also could have implications for political participation, especially if consuming drugs and alcohol leads to deteriorating health conditions (Burden et al. 2016; Pacheco and Ojeda 2020).

While many demographic changes induced by shale gas booms imply that political participation by individuals in the affected areas may not be linearly correlated with income increases, other changes in fracking areas may trigger more civic engagement. Fracking has become a politically contentious issue, especially after 2010.[1] Supporters and opponents of fracking have debated the effect of the shale gas boom on local economies and the environment. While supporters emphasize the positive effect of fracking on wages and employment, opponents

1. For instance, a Google trend search on the term "fracking" shows that searches on fracking increased sharply around 2010 (see fig. A1).

raise concerns about effects on the environment (Christenson, Goldfarb, and Kriner 2017). Starkly different opinions about fracking correspond with party: according to Gallup, 55% of Republicans, but just 25% of Democrats, supported fracking in 2016 (Swift 2016).

Amid concerns that shale development could cause earthquakes and water contamination, Congress considered (but did not pass) legislation that would remove the current exemptions of fracking activities from the Safe Drinking Water Act. In contrast to limited authority and actions by the federal government, state governments have begun to introduce legislation addressing severance taxes, impact fees, and disclosure of chemicals used in underground injections. The state of New York famously imposed a moratorium on fracking activities in 2014, citing health risks (Kaplan 2014). Some legislative efforts have been countered by energy industries that support fracking. A *New York Times* article identifying types of megadonors for the 2016 presidential campaign listed "The Frackers," those who accumulated enormous fortunes from energy booms, as the top group (Lichtblau and Confessore 2015). This suggests that wealthy individuals, energy companies, and industries that benefit from shale gas booms may increase their political participation, especially by making campaign contributions.

THEORETICAL EXPECTATIONS

Given its scope, it is unlikely the fracking boom has not touched political participation in these communities, although our theoretical expectations for voting are ambiguous. On one hand, if fracking increases employment and wages, this increase in economic resources should lead to increases in voter participation. If individual voters living in these areas begin to see a connection between the broad public policy issue of fracking and their own interests, they may also be more likely to vote. On the other hand, decreases in years of education, increases in substance abuse that could lead to deteriorating health conditions, and increased migration may negatively affect individuals' civic resources and social capital, leading to declines in voting.

We are more confident in predicting a positive impact of fracking on campaign contributions. The income gains induced by fracking likely affect all residents of a community, but especially those at the top of the income distribution. These high-income residents will have more of a stake in public policies that benefit the fracking industry overall, and so will be more motivated to participate. At the same time, high-income residents are less likely to be negatively affected by fracking's externalities (e.g., they are already highly educated and so need not forgo college education in order to work in the shale gas industry).

Given existing results showing a conservative shift in the voting records of legislators from these areas, we expect that any participatory impacts will vary in ways that benefit Republicans. For instance, if we find that voting increases (decreases), we would expect the effects to be concentrated among Republicans (Democrats). We also expect that campaign contribution increases in fracking areas after booms will be more prevalent among Republican candidates than Democratic candidates.

At the individual level, this partisan asymmetry is theoretically driven by the emergence of a gap between voter/donor preferences and legislators. Although existing studies show that both Democratic and Republican voters in shale boom areas became more supportive of fracking mainly because voters think fracking has provided economic benefits in their communities (Boudet et al. 2018), there are few behavioral changes in incumbent politicians' voting behavior on environmental and other issue areas after the booms. Specifically, Democratic House incumbents who stayed in office after fracking did not adjust their voting behaviors in more pro-fracking directions (Cooper et al. 2018). Given that the Republican Party has supported fracking activities and the Democratic Party has been more vocal on environmental and health concerns, this implies the gap between voter and elite preferences would be smaller for Republicans than Democrats after fracking booms. Extant literature shows that the degree of alienation between voters and candidates is strongly correlated with turnout (Adams and Merrill 2003). Therefore, we expect changes in participation to move in a direction that benefits Republican candidates.

DATA

We collect annual oil and gas production data at the well level from Drillinginfo.com, an energy information service firm. Drillinginfo.com provides oil and gas production data in detail for each month, including geographic coordinates that allow us to match wells with zip codes and whether a property was drilled horizontally or vertically. Following Fedaseyeu et al. (2018), we use the Drillinginfo.com data to construct a measure of the total number of horizontal wells in a given geographic area in a given year.[2] Figure 2 shows the cumulative number of horizontal wells from 1990 to 2016 by county. The Appalachian Basin (Marcellus shale play) in Pennsylvania and New York, the Fort Worth Basin (Barnett shale play) in Texas, and the Williston Basin (Bakken shale play) covering North

2. We obtained a list of wells that included their geographic coordinates and year of first operation, matching wells to zip codes using the spatial join procedure in geographic information system (GIS) software. We assume that once a well opens, it remains open.

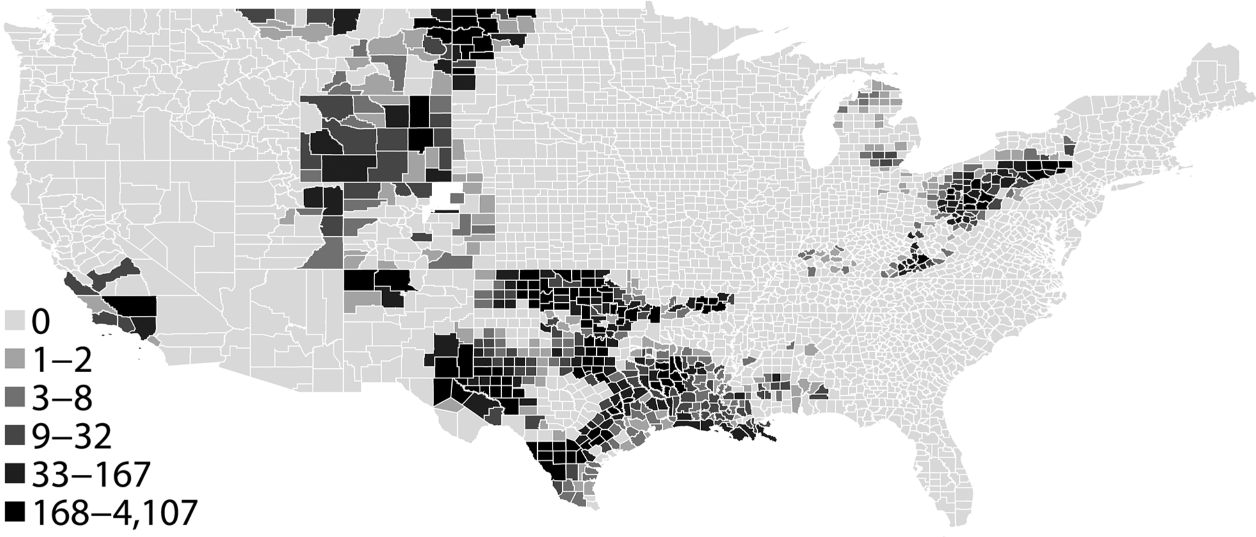

Figure 2. Cumulative number of horizontal gas wells by county, 1990–2016

Dakota and Montana show the most active shale gas and oil development.[3]

To measure voter participation, we use data from Catalist LLC, a data vendor that collects various types of information on registered voters and provides data sets to the Democratic Party and liberal organizations (Ansolabehere and Hersh 2012). Catalist provides "analytical samples" to academic institutions that comprise 1% of all individuals in Catalist's database. Our sample comprises information on 3.2 million individuals from all 50 states, including voting and registration history back to 2000. We match individuals from the Catalist file to shale well areas using voter zip codes.

A Catalist sample from year 2012 (for example) contains information on all those who were registered as of 2012. Thus in our case, voters coded as living in fracking areas will include those who moved into these areas and registered to vote between 2000 and 2012, and voters coded as living in nonfracking areas will include those who moved out of fracking areas between 2000 and 2012. There is evidence that fracking communities attract new residents, but these residents tend to be younger and less educated than other movers (Wilson 2016). As movers in general are less likely to register (Ansolabehere, Hersh, and Shepsle 2012), we would not expect movers to fracking areas to be a significant portion of new registrants over this period. There is also some evidence that fracking leads to out-migration, but the closest study of this question concludes that any out-migration is in fact driven by the "churn" of transient workers (Wilson 2016), who likely did not register to vote at all.

3. The shale rock formations that trapped natural gas and oil below the earth's surface are referred to as shale plays.

Panel a of table A1 shows summary statistics for our voting data. The sample sizes and averages for voting vary across years for two reasons. First, Catalist voters observable in the 2012 data will not be observed in 2000 if they were under 18 or ineligible to vote for some other reason. Second, to measure voting for all years between 2000 and 2016, we combine two 1% samples. Sample A is time stamped 2012 and includes a 1% sample of voters from 2012 and their electoral history between 2000 and 2012. Sample B is time stamped 2016 and includes a different 1% sample of voters and their electoral history between 2004 and 2016. We combine these files by taking only the 2016 history of sample B and appending it to sample A. Our results are robust to including all years or appending the 2000 history for sample A to the entire sample B. Given the varying sample sizes across years, we treat the Catalist data as "repeated cross-sections," and we include zip code fixed effects. Later in the article, we use individual fixed effects as a robustness check.

Given that the Catalist data we use do not allow us to calculate the turnout rate in a specific zip code, our measure of voting should be interpreted as the probability that a currently active voter turned out in a given election. Voters whose turnout we observe in all years may be especially likely to vote, while those we do not observe in 2012 and 2016 may have voted in prior years but became inactive before the most recent years. For this reason, our voting measure is disproportionately higher in earlier years, and this could induce trends leading to a higher risk of false positives. In appendix section A.15, we explore the extent of this issue by randomly assigning a fictitious zip code–level treatment to the Catalist data. We never observe a placebo estimate as large as our observed estimates, suggesting that our actual results are unlikely to be false positives. We also supplement the individual-level voting analysis with the aggregate-level analysis at the county level, which allows us to calculate turnout rates, as the county-level information provides both the total votes cast at the county as well as the county's voting-age population from the US census.

To measure campaign contributions, we use the Database on Ideology, Money in Politics, and Elections, public version 2.0, for campaign contributions from 2000 to 2014 (Bonica 2016). Each row in the original data set is a contribution made by an individual or an organization in a given election cycle. We aggregate the contributions data to the donor level by summing donations within contributors. Panel b of table A1 shows summary statistics. In addition to the total contributions, we measure the contributions to Republican and Democratic candidates.[4]

RESEARCH DESIGN

Given the structure of our data, the natural estimation strategy is a difference-in-differences regression of participation on fracking with year and zip code fixed effects.[5] This specification compares outcomes between those living in areas that did and did not experience fracking, before and after fracking occurs. It relies on the assumption that overtime changes in nonfracking areas provide a sound counterfactual for what would have happened in fracking areas, had they not fracked.

To begin to probe this assumption, table 1 compares pre-boom outcomes between counties that did and did not experience fracking over the sample period (i.e., counties that eventually had at least one horizontal well compared to those that always had zero).[6] The top panel includes data from all states and shows considerable baseline differences. For instance, even in 2000, counties that would eventually frack had lower voter turnout, were less Democratic, had lower incomes, and so on. Of course, baseline differences between groups pose no problem for difference-in-differences analyses, since the point of the design is that such baseline differences are controlled for. However, the substantial baseline differences suggest there could be differences in trends as well.

We address possible violations of the parallel trends assumption in several ways. First, we replicate all our results in the seven states with particularly large amounts of fracking activity: Arkansas, Louisiana, North Dakota, Oklahoma, Pennsylvania, West Virginia, and Texas.[7] Given that fracking and nonfracking areas among these seven states are plausibly more similar to one another, the nonfracking areas in these states are a better counterfactual group. In the bottom panel of table 1, we present comparisons of means that support this argument. Comparing fracking and nonfracking counties in high-fracking states in the year 2000, we find virtually no average difference in baseline characteristics. Importantly, there is no statistical difference in turnout in the 2000 presidential election between fracking and nonfracking counties in high-fracking states. The exceptions are Democratic vote—fracking areas are still about 3.5 points less Democratic on average—and competition, defined as $-|\text{Democratic presidential vote share} - 50|$.

Second, we test for differential trends in outcomes before the fracking boom. It is more plausible that fracking and nonfracking areas would have experienced "parallel trends" in the post-fracking period if they were, in fact, experiencing parallel trends (regardless of differences in their baseline characteristics) in the prefracking period. To test whether this is the case, we examine average outcomes for areas that had any horizontal wells (treatment group) and for those that never had any wells (control group), before and after the fracking boom began. As shown in figure A2, fracking and nonfracking areas have similar trends in the preboom era, and there are only small differences

4. We limit the analysis to individual contributors, excluding political action committees and other organizations. We also limit the analysis to contributions made to candidates for president, Congress, and state legislatures. We only observe contributors if they give to candidates. If a donor gives exclusively to candidates from one party, we code donations to the other party as zero. This ensures all our analyses are conducted on the same sample of donors, regardless of the outcome measure used.

5. The ZIP (Zone Improvement Plan) code was introduced in 1963 by the US Postal Service to improve the efficiency of mail delivery. The United States has around 30,000 general zip codes, excluding military and PO Box zip codes. The average population size per zip code is 9,436, and the median population size is 2,805, according to the 2010 census. Although there are a few zip codes where the size of the population is over 100,000, most zip codes cover a relatively small population size. Data source: US Census Bureau, ZIP Code Tabulation Areas, https://www.census.gov/programs-surveys/geography/guidance/geo-areas/zctas.html (accessed March 15, 2019).

6. We use counties for this analysis because zip code–level demographic data are often unavailable. Turnout data come from David Leip's Election Atlas; we divide Leip's total votes measure by the county voting-age population from the US census. Median income, the share with a college degree or higher, and the Gini Index—a measure of income inequality—all come from the US census for 2000 and the American Community Survey (ACS) five-year estimate for 2012–16; unemployment comes from the 2000 census and the 2008–12 ACS. We use the Internal Revenue Service's Statistics of Income data on migration to construct a measure of "net migration" to a county. Using counts of tax returns, we divide the number of returns noting a move into the county by the number of returns noting a move out of the county (data source: https://www.irs.gov/statistics/soi-tax-stats-migration-data, accessed April 24, 2019). Last, we obtain a measure of the rate of deaths due to drug poisoning per 100,000 county residents from the National Center for Health Statistics under the Centers for Disease Control and Prevention (data source: https://www.cdc.gov/nchs/data-visualization/drug-poisoning-mortality/index.htm, accessed April 24, 2019).

7. We adopt our coding rule from Fedaseyeu et al. (2018). Citing federal Energy Information Administration data, these authors report that 92% of all horizontal drilling takes place in these seven states. In app. sec. A.8 we show our results are robust to alternative codings of "high fracking."

Table 1. Prefracking Differences between Fracking and Nonfracking Areas

	Never Fracked (1)	Ever Fracked (2)	Difference (2) − (1)
All states:			
Turnout	53.88	51.59	−2.29***
			(.49)
Democratic %	41.66	37.64	−4.01***
			(.67)
Competition	−11.74	−15.02	−3.28***
			(.50)
Income ($1,000s)	35.82	31.68	−4.14***
			(.36)
Gini	43.19	45.06	1.87***
			(.18)
Unemployment	5.62	6.55	.93***
			(.15)
College %	16.73	14.98	−1.75***
			(.32)
Migration	95.47	88.26	−7.21***
			(.94)
Drug deaths	5.63	6.02	.39
			(.20)
High-fracking states:			
Turnout	50.18	50.38	.20
			(.68)
Democratic %	40.52	36.98	−3.54***
			(.96)
Competition	−12.58	−15.34	−2.76***
			(.71)
Income ($1,000s)	31.69	31.62	−.07
			(.53)
Gini	45.08	45.31	.23
			(.26)
Unemployment	6.19	6.23	.04
			(.21)
College %	14.70	14.86	.16
			(.46)
Migration	90.28	88.69	−1.59
			(1.54)
Drug deaths	5.78	5.31	−.47
			(.27)

Note. Prefracking differences between counties that did and did not experience fracking over the sample period. Means (cols. 1 and 2) or differences in means (col. 3), with robust standard errors in parentheses.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

in preboom baselines when restricting analysis to the high-fracking state sample. Below, we also use an individual-level regression specification that similarly tests for pretrends.

Third, we use shale plays as an instrumental variable for fracking (e.g., Feyrer et al. 2017). That is, we match zip codes to shale plays (using GIS data from the federal Energy Information Administration) and use a zip code's presence in a shale play to predict the presence of fracking. We report the results in tables A3 and A4. These results are consistent, although they are not statistically significant for our analysis of contributions in high-fracking states.

We note two other issues for our analysis. First, because the distribution of horizontal wells is highly skewed, we use two measures of fracking activity: the log number of wells in a zip code plus one and a dummy variable equal to 1 if a zip code has any horizontal wells at time t and 0 otherwise.[8] Second, wells and participatory outcomes are both highly persistent over time, leading to high serial correlation that in turn increases the risk of false positives (Bertrand, Duflo, and Mullainathan 2004). For instance, current presidential turnout is correlated with past presidential turnout at 0.89 in our data, and the log number of wells is correlated with the four-year lag of log wells at 0.93. Therefore, we cluster standard errors at the zip code level. As a robustness check on the main results, we implement a "long-difference" specification that compares changes in outcomes over several years between fracking and nonfracking areas (Bertrand et al. 2004).

THE EFFECT OF FRACKING ON VOTING

First, we examine the effect of shale gas booms on voting. Because different areas began to experience fracking at different times, we use a difference-in-differences regression of the form

$$\text{voted}_{izt} = \alpha + \beta \times \text{fracking}_{zt} + \text{zip code}_z + \text{year}_t + \varepsilon_{izt}, \tag{1}$$

where voted_i is equal to 1 if a voter voted in a presidential election and 0 otherwise, and i indexes voters, z zip codes, and t election years.[9] This specification compares voters in zip codes that experience fracking to voters in zip codes that do not, before and after the introduction of fracking. As mentioned above, we use two different measures of fracking: log wells plus one and a binary indicator for the presence of at

8. Table A5 reports similar results using two additional measures of wells: the inverse hyperbolic sine and the year-over-year change in the number of wells.

9. Individuals coded as missing for a particular election are excluded in the analysis for that election.

Table 2. The Effect of Fracking Booms on Voting

	All States			High-Fracking States		
	(1)	(2)	(3)	(4)	(5)	(6)
Log wells	−.021***			−.009**		
	(.002)			(.003)		
Any wells		−.047***			−.019**	
		(.006)			(.007)	
Ever fracked × post			−.024***			−.047***
			(.006)			(.009)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Zip code fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	29,584	29,584	29,128	5,746	5,746	5,587
Observations	9,447,267	9,447,267	3,576,165	1,256,937	1,256,937	447,765

Note. Regression coefficients, with zip code–clustered standard errors in parentheses. The dependent variable is a binary indicator for turning out to vote. The unit of observation is the voter. Columns 1, 2, 4, and 5 estimate eq. (1); cols. 3 and 6 estimate eq. (2). Regressions include a constant term, which is omitted from the table.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

least one well. To address serial correlation, we also estimate a long-differences specification:

$$\begin{aligned}\text{voted}_{izt} = \alpha + \beta \times (\text{ever fracked}_z \times \text{post}_t) \\ + \text{zip code}_z + \text{post}_t + \varepsilon_{izt},\end{aligned} \tag{2}$$

where "ever fracked" is an indicator for the presence of any wells over the sample period. We fit this specification for years 2000 and 2012 only (post_t indicates the year 2012). The restriction of the sample to these years makes it a comparison of voting in 2012 to voting in 2000 between zip codes that ever fracked and those that never fracked.[10]

Table 2 presents the results.[11] Column 1 presents estimates using the log number of wells in a zip code. Here the estimate is −0.021, with a standard error of 0.002. This estimate indicates that as the number of wells increases by 1%, the probability a voter turns out declines by $0.021/100 = 0.0002$ on a 0–1 scale.

In column 2, we use an indicator for whether a zip code has any horizontal wells (i.e., we treat zip codes with few and many wells equally). Here the point estimate is −0.047, with a standard error of 0.006. When fracking begins in a zip code's area, individuals in that area become roughly 5 percentage points less likely to vote, relative to the change in voting in zip code areas where fracking does not begin during the same period.

Column 3 presents the long-difference estimates. The key coefficient here is the interaction between ever having any wells and the post period. The estimate is −0.024, with a standard error of 0.006. Substantively, this means that compared to those living in nonfracking zip codes, those living in fracking zip codes became two points less likely to vote between 2000 and 2012.

Columns 4–6 replicate the analysis for the seven states with particularly large amounts of fracking activity: Arkansas, Louisiana, North Dakota, Oklahoma, Pennsylvania, West Virginia, and Texas. A priori, we might expect larger and more precise effects for voters in zip codes in these states, given the larger amount of fracking activity. Yet, focusing on seven states significantly reduces our sample size and reduces variation in the fracking variable given potential spillovers within states. In practice, we find similar estimates in these states. For instance, we find that voters in zip codes with any horizontal wells become about 5 percentage points less likely to vote, relative to the changes experienced by voters in nonfracking zip codes in these states (col. 6).

The negative impact of fracking on voting is supported by the analysis including voter fixed effects (table A2) as well as

10. In table A7, we check the robustness of our results when using state-year fixed effects instead of year fixed effects. Estimates using the log wells measure are still negative but no longer significant in these specifications. Estimates using the alternative measures are negative, smaller in magnitude, and less precise but still significant at conventional levels.

11. In the main specifications, we cluster the standard errors at the zip code level. Our results are robust when we cluster the standard errors at the state × year level to address potential spillovers and spatial correlations.

the instrumental variable analysis (panel a in table A3). The individual-level analysis is particularly important to pin down whether the effect of local economic shocks on political participation happens through individual-level changes or changes in community composition. Existing studies on this topic are mostly done at the aggregate level, so it is challenging to separate the two channels. For example, Charles and Stephens (2013) find that higher local wages and higher employment cause lower voter turnout in elections, except presidential races. Their results are based on the aggregated county level, and an important issue for causal interpretation of their results is the issue of migration. If the types of individuals who migrate into booming counties have characteristics that are systematically associated with voting, the voting effect from local economic conditions could be mainly driven by changes in voter composition. Charles and Stephens discuss the potential effects of migration on their analysis and argue that, given that "the vast majority of migration in response to the energy price shocks occurred across counties within states rather than between states" (128), migration cannot explain the statewide election results. However, a pattern of migration raises a concern about the compositional changes in voters at the county level, regardless of whether migration mostly happens within states or across states. Therefore, it is crucial to have longitudinal individual-level data to compare the effect of local economic booms on political participation of the same individuals before and after the boom to isolate the causal effect of local economic shocks from the effect of compositional changes. Our analyses at the individual voter and donor level directly tackle this challenge.

In doing so, we face some obstacles. As we note above, our Catalist data contain the zip code of registration in 2012 (or 2016) but not any previous addresses. Therefore, it is difficult to know whether the voters registered in 2012 had registered in previous elections and lived at the same locations during each election cycle. What we do know is whether a voter lived in a fracking area in 2012 (or 2016). If there were active migration in and out of fracking areas and those movers account for a significant portion in the registered voters, it would be difficult to disentangle individual-level and compositional changes.[12]

We use several strategies to address this issue. First, we limit the sample to voters whose turnout we observe consistently between 2000 and 2012 and so plausibly have lived in the same state over the sample period (see table A8). Second, we drop voters who are low education, young, and male and thus likely to be drawn to fracking communities for employment (see table A9). Third, we limit the sample to the most recent years only, which should reduce the amount of movement over the sample period (see table A16). Overall, these additional results suggest that a decrease in voting is mainly driven by individual-level changes, not by the changes in voter composition in fracking communities.

THE EFFECT OF FRACKING ON CAMPAIGN CONTRIBUTIONS

Table 3 shows the results with the logged sum of total contributions (plus one) as the outcome, using the same specifications employed in our voting analysis. In column 1 we use the log number of wells as the key predictor. Here the coefficient is 0.081, with a standard error of 0.008. Thus, for every 1% increase in the number of wells, contributions increase by about 0.081/100 or 0.0008. In column 2, the estimate is 0.239, with a standard error of 0.019, suggesting that donors living in zip codes with any fracking see relative increases in donations of about 24%.

Column 3 shows the long-difference results. The interaction between ever fracking and post shows that compared to zip codes that never fracked, donors living in fracking zip codes increased contributions by about 38% (standard error of 2.7) between 2000 and 2012. Columns 4–6 repeat the analysis for only the seven high-fracking states. Restricting the sample in this way for contributions reduces the magnitude and precision, but the results are substantively similar to the all-states sample.

ACCOUNTING FOR PRETRENDS

As a further test of the validity of our design, we estimate a variant of the long-differences specification that incorporates all years pre- and postboom. We include individual fixed effects, thus ensuring we are comparing the same individuals under different values of the fracking variable. This regression takes the form

$$\begin{aligned}\text{voted}_{izt} &= \alpha + \sum_{s=1}^{S<2004} \delta_s \times (\text{ever fracked}_z \times \text{year}_s) \\ &\quad + \sum_{t=1}^{T\geq 2005} \beta_t \times (\text{ever fracked}_z \times \text{year}_t) \\ &\quad + \text{voter}_i + \text{year}_t + \varepsilon_{izt}.\end{aligned} \tag{3}$$

The δ coefficients represent preboom differences between voters living in areas that eventually fracked and those that did not, net of individual averages and time trends. Likewise, the β coefficients represent these differences in the postboom period.

12. However, Wilson (2016) documents that the migration response to fracking areas is short term in nature, and in-migration is substantial only in the state of North Dakota. In other fracking states, the magnitude of in-migration is never more than 1.1% of the baseline population (18).

Table 3. The Effect of Fracking Booms on Campaign Contributions

	All States			High-Fracking States		
	(1)	(2)	(3)	(4)	(5)	(6)
Log wells	.081***			.029***		
	(.008)			(.008)		
Any wells		.239***			.119***	
		(.019)			(.023)	
Ever fracked × post			.378***			.209***
			(.027)			(.032)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Zip code fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	29,699	29,699	28,530	5,719	5,719	5,390
Observations	11,961,688	11,961,688	3,559,403	1,690,234	1,690,234	500,947

Note. Regression coefficients, with zip code–clustered standard errors in parentheses. The dependent variable is logged total individual contributions plus 1. The unit of observation is the donor. Columns 1, 2, 4, and 5 estimate eq. (1); cols. 3 and 6 estimate eq. (2).
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Figure 3 plots the interactive coefficients from these regressions.[13] For voting, note that we only observe one pretreatment period difference because the data began in 2000, and one year must be omitted as a reference category.[14] The coefficient for 2004 tells us that between 2000 and 2004, voters living in these two types of areas were moving in parallel. After 2005, however, we see decreases in voting that are consistent with the result shown earlier. For contributions, we have two pretreatment coefficients and the results are similar, save that we do see a slight increase in contributions in 2002 relative to 2000 in the all-states sample. However, when we limit the sample to high-fracking states, both preboom coefficients are around zero and are insignificant.[15]

POTENTIAL MECHANISMS

Considering past research, it is intuitive that campaign contributions should increase as a result of fracking's positive shock to the local economy and personal incomes (Ansolabehere et al. 2003). It is somewhat less intuitive that such a shock would decrease voter participation. Previously, we argued possible negative effects could occur because of various negative externalities induced by fracking. In this section, we use county-level outcomes to probe this argument. In the process, we show that our voting results are robust to using county-level turnout data.

Given that most of our county-level outcomes are from the decennial census and the fracking boom began around 2005, we simply compare changes in outcomes between 2000 (before the boom) and 2010 or 2012 (depending on data availability)—after the boom—between counties that ever fracked and those that never fracked. That is, we estimate a series of regressions

$$y_{c,\text{post}} - y_{c,\text{pre}} = \alpha + \beta \times \text{ever fracked}_c + \varepsilon_c,$$

where c indexes counties. We use heteroskedasticity-robust standard errors for this analysis.

Table 4 presents the results, starting with all states in the top panel. We begin with voter participation. Given that voting and wells are highly serially correlated, this analysis shows that our results are robust to a long-differences comparison that addresses this issue (Bertrand et al. 2004). Here the point

13. Table A2 shows results from regressions with voter and donor fixed effects but without the time interactions.

14. The reference year is 2000. We also omit 2016 data for this figure, as our 2016 measure comes from a separate Catalist sample; see the Research Design section above. Thus, we have two years of pretreatment data for voting, and the first coefficient represents any differential trend from 2000 to 2004.

15. An alternative means of testing for pretrends is to leverage zip code–level variation in the timing of fracking adoption. We prefer the time-invariant fracking measure for this test because it is easier to interpret. Also, we do not have many time periods overall, and not much variation in years when fracking is switching "on" and "off," so we lose power using lag and lead dummies. Another reason to prefer the pre-/post-2005 specification is that we can argue that the national boom in fracking that occurred around that time was exogenous; in contrast, using the timing of local-level adoption may introduce confounding from anticipation effects. All that said, in fig. A3, we present estimates from regressions using leads and lags of our fracking measures. The results are substantively similar.

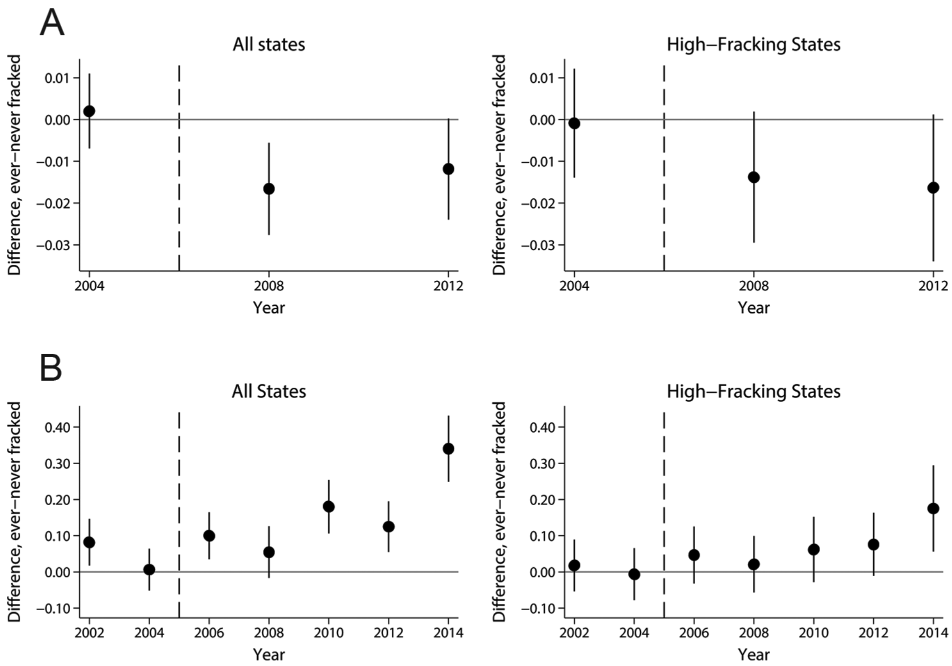

Figure 3. Difference in individual-level outcomes between those living in areas that ever fracked and those that did not, by year. *A*, Voted; *B*, log(donations + 1).

estimate suggests a decline in county-level turnout of 3.03 points, with a standard error of 0.32 points.

We next examine two other political variables. First, several recent studies find that fracking leads to more conservative voters (Fedaseyeu et al. 2018) and, in turn, more conservative politicians (Cooper et al. 2018). Here we compare fracking and nonfracking counties in terms of the Democratic share of the two-party vote in presidential elections. Consistent with past results, we find the difference-in-differences estimate is −4.51, with a standard error of 0.43. Second, we examine changes in electoral competition. We find that fracking areas become less competitive relative to nonfracking areas (the difference in differences is 3.16, with a standard error of 0.35).

Next, we examine three economic variables, starting with median income (measured in thousands of dollars). In table 1, we saw that even before fracking, fracking counties had median incomes that were almost $4,000 lower than nonfracking counties. The effects of the Great Recession were markedly smaller in fracking areas, however: income actually grew in fracking counties while it shrank in nonfracking counties, so that while fracking counties remained less wealthy after fracking than nonfracking counties, the gap was reduced. The difference-in-differences estimate in table 4 indicates that the economic effect of fracking on median income is $3,570 (standard error of 0.25).

Fracking's positive shock to income did not increase income inequality, which may depress turnout (e.g., Solt 2008). While fracking areas had higher Gini coefficients before and after fracking, income inequality actually went down in fracking areas and increased in nonfracking areas. The difference in differences here is −0.76 (on a 100-point scale), with a standard error of 0.16. Also relevant for fracking's economic impact, we find large reductions in unemployment due to fracking (estimate of −2.21, standard error of 0.16).

Last, we examine effects on measures of "social capital": education, migration, and deaths from drugs. Fracking areas had lower rates of college attainment before fracking; while college attainment increased across the United States over this period, the increase was smaller in fracking areas. Thus, the difference in differences suggests fracking caused a 1 percentage point decline in college attainment. We also find that fracking increased net migration—defined as the ratio of the number of persons moving into a county divided by the number of persons moving out of a county—by 8.22 points (standard error of 1.23). We do find an increase in drug deaths per 100,000 county residents (estimate of 0.29), but the estimate is not statistically significant (standard error of 0.18).

The bottom panel of table 4 replicates the analysis for the seven high-fracking states. Recall that in table 1 we saw that restricting the sample in this way substantially limits prefracking differences. Nonetheless, the difference-in-differences estimates are generally similar to the full sample results. Fracking decreases county-level turnout by 0.98 points (standard error of 0.44), decreases Democratic vote share by 1.04 (standard error of 0.64), and decreases political competition by 1.58 (standard error of 0.54). The income effect is smaller

Table 4. The Effect of Fracking on County-Level Outcomes

	Turnout (1)	Democratic Vote (2)	Competition (3)	Income (4)	Gini (5)	Unemployment (6)	College (7)	Migration (8)	Drug Deaths (9)
All states:									
Fracking	−3.03***	−4.51***	−3.16***	3.57***	−.76***	−2.21***	−1.07***	8.22***	.29
	(.32)	(.43)	(.35)	(.25)	(.16)	(.16)	(.13)	(1.23)	(.18)
Constant	2.90***	−1.39***	−2.86***	−3.15***	.20***	3.18***	3.69***	3.72***	7.41***
	(.11)	(.15)	(.12)	(.07)	(.05)	(.06)	(.05)	(.41)	(.07)
Observations	3,085	3,099	3,099	3,099	3,099	3,099	3,099	3,070	3,099
High-fracking states:									
Fracking	−.98*	−1.04	−1.58**	2.04***	.26	−.78***	−.73***	3.94*	−.30
	(.44)	(.64)	(.54)	(.34)	(.25)	(.23)	(.20)	(2.00)	(.28)
Constant	.18	−5.87***	−5.38***	−1.09***	−.73***	1.53***	3.32***	9.36***	7.51***
	(.26)	(.48)	(.41)	(.19)	(.17)	(.17)	(.14)	(1.42)	(.20)
Observations	645	645	645	645	645	645	645	640	645

Note. Regression coefficients, with robust standard errors in parentheses.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

compared to the full sample, but still precisely estimated, at about $2,000 (standard error of about $340). While the impact on the Gini coefficient is now estimated to be positive, it is very imprecise, suggesting no impact either way. Turning to the social capital variables, the signs of the estimates for education and migration are the same as in the full sample, although they are smaller in magnitude and less precise. However, fracking's negative impact on college attainment remains highly statistically significant, even when we focus only on high-fracking states. In terms of drug deaths, the sign of the estimate reverses and is still not significant.

While it is challenging to precisely deconstruct the impact of fracking on voting, the results in this section are suggestive. They are also consistent with our argument that fracking brings various impacts to a community, some of which may positively influence voting (e.g., economic resources) and others that may negatively influence voting (e.g., declines in education).

PARTISAN ASYMMETRY IN POLITICAL PARTICIPATION

Past studies show Republican candidates in presidential, congressional, and state gubernatorial races gain substantial support after fracking booms (Fedaseyeu et al. 2018). Changes in voter preferences and increased support from business interests are both plausible mechanisms through which Republicans gained substantial electoral advantages after shale booms. However, it is not clear how voter preference changes and business interests' support after fracking booms are translated into electoral support. To fully understand the mechanisms behind conservative advantages in elections after the shale boom, we must examine whether fracking has any partisan effects on voting and campaign contributions.

To investigate the partisan effects of fracking on voting, we use Catalist's model-based prediction of individual ideology, based on voting records and demographic information. This score ranges from 0 to 100, with higher numbers indicating greater liberalism. Given that fracking states are more conservative overall, we create a relative liberalism score for each individual within a state to identify which group of voters within a state is more affected by fracking booms. First, we calculate the average ideology of individuals in the same state; we then subtract the state-level average ideology from an individual's ideology. This index gives the relative liberalism of an individual compared to individuals who live in the same state. We divide individuals into five quintiles from the most conservative to the most liberal. We then create interaction terms between a fracking variable at the zip code level and each quintile. In table A10, we report regression results using our three measures of fracking (log wells, any wells, and a long-difference estimator). Here, we graphically report results using the "any wells" indicator.

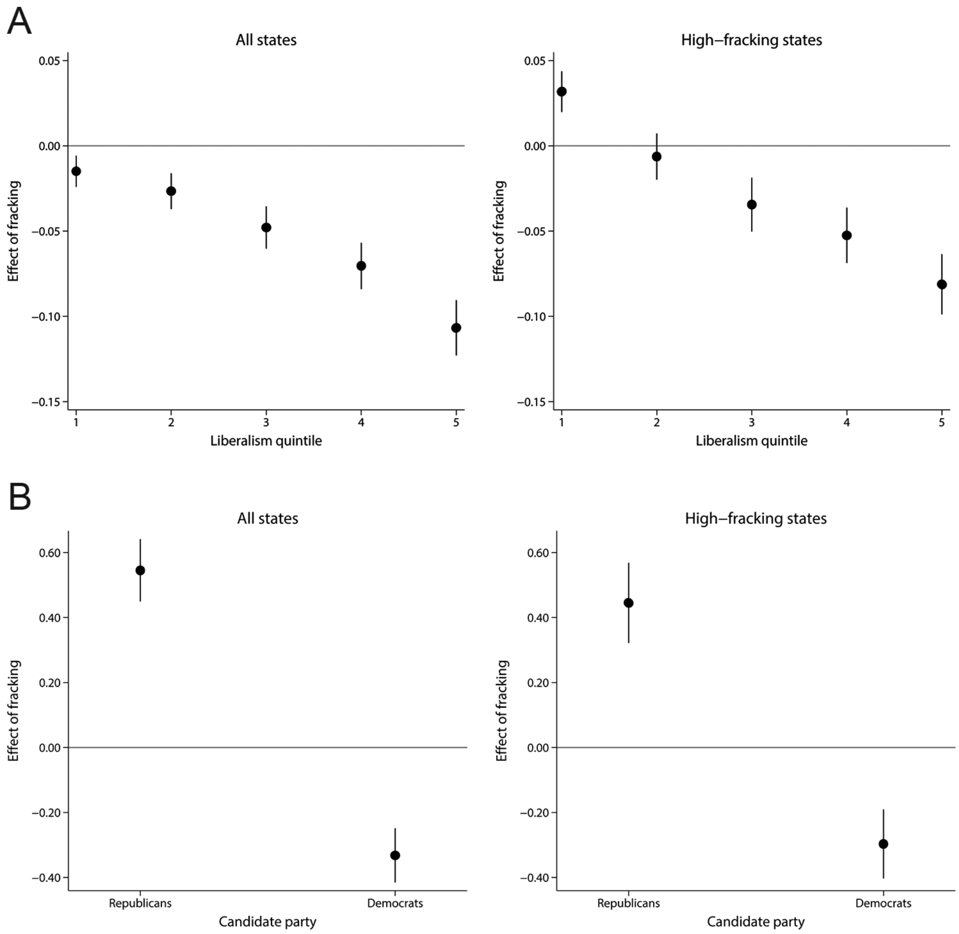

Figure 4. Differential effects by ideology and party. *A*, Marginal effect on turnout of any wells by Catalist ideology. *B*, Results for two outcomes, contributions to Republican candidates and contributions to Democratic candidates.

Figure 4*A* shows the results for voting. In the full sample, effects on voting are negative for all ideological subcategories. Although we enter in the ideology variable using a separate interaction for each quintile, the results are linear, with more negative impacts on voting as liberalism increases. For the most conservative voters, the estimate suggests a roughly 4 percentage point decline; for the most liberal voters, the estimate is about three times as large. In the subsample of voters in high-fracking states, the most conservative voters actually see a slight increase in voting of about 2 percentage points; all other groups see a decline, with the most liberal voters seeing a decline of around 7 points.

We show results for donors in figure 4*B* (regression results appear in table A11). Instead of using interactions, here we conduct separate difference-in-differences regressions using total contributions to Republican candidates as one outcome and total contributions to Democratic candidates as another. For both the full sample and the high-fracking states, we see contributions to Republicans increase and contributions to Democrats decrease. In high-fracking states, the estimates suggest contributions to Republicans increased by about 23%, while contributions to Democrats decreased by about 19%.

In sum, the larger decline in voting by more liberal voters and the disadvantages that Democratic candidates suffered in fund-raising after fracking booms provide a microexplanation of the Republican Party's electoral success and the increased antienvironmental voting records of elected politicians from fracking areas. Although there is a clear partisan difference in public opinion on supporting fracking between Democrats and Republicans at the national level, Boudet et al. (2018) find that Democrats who lived closer to fracking sites were more supportive than those living farther away, indicating that proximity weakened the negative effect of Democratic partisanship on support for fracking. The media also reports a tension between labor union members in fracking areas who strongly opposed some of the Democratic presidential candidates' position on banning fracking (Friedman and Goldmacher 2020). Our own analysis of the Cooperative Congressional Election Survey regarding opinions on jobs versus environmental protection also suggests that Democrats in fracking areas did not become more supportive of environmental protection over jobs after fracking booms.[16]

This suggests that Democratic voters are more alienated from their party's policy positions after fracking booms, leading them to be less likely to turn out than Republican voters (Adams and Merrill 2003). When natural resource booms change voters' preferences but politicians do not change their policy positions following the booms, it often creates larger issues in congruence for liberal voters and donors, since positive income shocks tend to have conservative biases (Brunner et al. 2011; Doherty, Gerber, and Green 2006). There may be another related mechanism behind this partisan asymmetry. When the Republican Party is consistently profracking, Democratic voters in fracking areas become less likely to turn out because they may perceive economic benefits are delivered by the opposition party, weakening their motivation to turn out and vote (Chen 2013).

We also explore whether a larger decline in Democratic voters' voting and Democrat's fund-raising disadvantage are driven by differences in the types of candidates (supply of candidates) in terms of the quality and the ideology between the Democratic and Republican Parties. Tables A12–A14 present the results. Our analysis reveals that Democratic candidates who competed in primaries for House of Representative races did not become more conservative as measured by campaign finance (CF) scores (Bonica 2016), and fracking areas did not show any particular patterns in terms of differences in challenger quality (Ban, Llaudet, and Snyder 2016; Jacobson 1989) between Democrats and Republicans after the boom. In state-level races, we find that the number of Republican candidates who ran in primary elections increased after the booms. Democratic candidates who ran in primaries or general elections for seats in states' lower chambers became more liberal, as measured by CF scores, after the shale booms. This finding supports our argument that there was a larger gap between the preference of Democratic voters and the policy positions or ideologies of Democratic candidates in fracking areas after the booms than the gap between Republican voters and Republican candidates.

CONCLUSION

The United States has experienced oil and shale gas booms over the last decades due to an extraction method known as "fracking," and this has fundamentally transformed many communities. Like resource booms in other countries, fracking has generated unprecedented levels of increased income and wealth to individuals and business groups. Despite fracking's significant effect on income and wealth and sharply opposing opinions on the desirability of fracking, it is striking how little research has been done to analyze its effect on the political behaviors of individuals. Income has been shown to have one of the strongest correlations with many forms of political participation, such as voting and campaign contributions. When positive economic shocks increase the material fortunes of individuals, do they change their political participation? Understanding the microlevel changes in political behaviors brought by natural resource booms is critical to understanding the consequences of fracking on electoral competition and, ultimately, on public policy.

Using zip code data on horizontal gas wells, we provide systematic analysis of the effect of the fracking boom on different types of political participation. Our analysis reveals that, despite a substantial increase in income and wealth in fracking areas, fracking appears to have had a negative impact on voter participation. We document that declines in educational attainment also occur in fracking areas, and this factor, combined with decreases in electoral competition, may be responsible for lowering voter participation. We also find that individual donors increased their contributions to state and federal candidates after fracking booms.

In addition, we highlight that shale booms have important partisan consequences. In fracking areas, liberal voters' participation declined more than conservative voters, and increased campaign contributions from fracking areas only benefited Republican candidates. Given that the environment is one of the most partisan issues in the United States (Egan and Mullin 2017) and the size of positive income shocks is quite significant, debates on fracking issues may galvanize Republican donors, whereas Democratic donors and voters might be cross-pressured between income changes and their preference for supporting the environment. Combined, this suggests fracking's impact on political participation has had unequal consequences. While some individuals and firms are energized to participate more in politics after resource booms, others may become less politically active. Examining the heterogeneous effects of political participation and the partisan implications of income shocks on policy outcomes will be a fruitful future research topic.

The fracking boom has infused new economic resources into many areas in the United States. Realizing the newfound importance of energy issues to their voters, elected politicians in these areas have voted more conservatively on environmental and other issues. We have shown that the link between this positive economic shock and the rightward elite shift is not simply explained by changing voter preferences. Rather, voters in fracking areas became less involved in politics overall, while the involvement of campaign contributors has grown. Moreover,

16. The results are presented in table A15.

the conservative shift in elite behavior seems to be due, at least in part, to the relative mobilization of Republican voters and donors compared to Democrats. In this case, at least, natural resources have been a blessing for one party but a curse for another.

ACKNOWLEDGMENTS

We are thankful for comments from Eric Arias, Joshua Clinton, Emanuel Coman, Jeffry Frieden, Michael Hankinson, Dave Lewis, Shom Mazumder, Victor Menaldo, Steve Rogers, Ken Shepsle, Mary Stegmaier, Charles Trzcinka, and Jan Zilinsky; panelists at the 2016 European Political Science Association annual meeting, 2017 American Political Science Association (APSA) annual meeting, 2017 Local Political Economy APSA Pre-conference at University of California, Berkeley, 2018 Midwest Political Science Association annual meeting; as well as seminar participants at Harvard University, London School of Economics, the Carlos III-Juan March Institute, Political Institutions and Economic Policy Conference at Indiana University Bloomington, University of Malaga, University of Warwick, Vanderbilt University, and Washington University in St. Louis. We also thank drillinginfo.com for sharing data.

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