Rock the Vote*

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Abstract

Models of democratic accountability argue that vote choice is governed by retrospective evaluations of candidates. However, democratic accountability could also operate through the mechanism of differential partisan turnout: when voters of one party are displeased with the other party's performance in office, they are more likely to turnout. I provide credible large-sample evidence of this mechanism by utilizing a natural experiment on over 1.3 million voters—exposure to fracking-induced earthquakes—that should be expected to affect one party more than the other. I find that precincts with high levels of earthquake exposure give a greater share of their vote to Democrats. And, consistent with my theoretical expectations, I find that experiencing fracking-induced earthquakes increases the likelihood of turning out to vote—especially for those who are registered with the Democratic Party. The results suggest that democratic accountability can and does operate through the mechanism of differential turnout.

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Introduction

The ability of citizens to hold their elected officials accountable for their actions in office is essential to a functioning democracy. Key (1966), for instance, claimed that "voters are not fools," and that their choices at the ballot box were based in large part on their rational assessments of an incumbent's performance. When incumbent politicians perform well, voters reward them with another term in office; when incumbents do not live up to their promises, voters throw their support behind some other politician. This notion of voters engaging in retrospective evaluations—over the economy (Fiorina, 1981; Alvarez and Nagler, 1998), incumbent behavior (Ferejohn, 1986), or some other issue—has long enjoyed a status of wide-spread acceptance among scholars of American politics. More recent work by Stokes (2016) corroborates these earlier findings by showing that citizens vote against incumbent parties that enact disliked—and potentially harmful—climate policies. Thus, there is ample evidence that voters engage in democratic accountability by examining prior governmental performance and voting based off of these considerations.

However, it is possible that democratic accountability can also operate through a different mechanism. Rather than assessing incumbent performance and deciding to reward a politician or party with one's vote based off of these assessments, democratic accountability has the potential to operate through the mechanism of producing differential partisan turnout. Indeed, Heersink et al. (2020) find that the decision to reward or punish a politician is conditional upon one's own partisan identification and that of the politician being assessed. Studying governmental responses to natural disasters, these authors find that co-partisans reward incumbents while out-partisans punish them (see also, Jones, 2019).

Though previous works have established voters' ability to hold politicians accountable, scholars have been unable to clearly determine whether this accountability can operate through the mechanism of differential partisan turnout. In this paper, I draw on data from the Oklahoma voter file and the U.S. Geological Survey (USGS) to study how voters react when exposed to earth-

quakes, the majority of which are caused by fracking or fracking-related processes. As the physical manifestation of a contentious policy, exposure to these earthquakes should cause voters to change their electoral behavior. Given that fracking is especially disliked by Democrats and supported by Republicans, this case offers a particularly compelling test of the differential turnout mechanism. Moreover, by drawing on individual-level data of over 1.3 million voters, I am able to avoid the inferential problems that have troubled previous examinations.

To preview the results, I find that higher levels of earthquake exposure at the precinct-level predict a greater share of the two-party vote for Democratic candidates in the 2016 general election. This result largely replicates previous findings of voters' willingness to engage in democratic accountability. Moreover, in an era of heightened nationalization (Hopkins, 2018) and straight-ticket voting (Jacobson, 2015), I find that this relationship holds for Democratic Presidential, Senate, and Congressional candidates. I then present a series of individual-level analyses that indicate that differential levels of partisan turnout is the mechanism producing this democratic accountability. Measures of individual-level exposure to earthquakes are most predictive and, in some cases, only predictive of turnout for those who are registered with the Democratic Party. Finally, I present results that show that these effects are most pronounced for those Democrats whose exposure to earthquakes increased between 2012 and 2016. Taken together, the results I present in this paper corroborate previous findings regarding voters' ability to hold politicians accountable. However, I find that—in an era of heightened partisan polarization (Bafumi and Shapiro, 2009; Abramowitz, 2010)—democratic accountability now has the ability to operate via the mechanism of one party's supporters turning out to the polls in greater numbers than the other party's supporters.

This paper proceeds as follows. First, I outline previous work on voter turnout and retrospective voting. Particular attention is paid to recent studies that focus on the role of natural disasters or climate-related policies and voter evaluations and turnout. In doing this, I develop a theory as to why exposure to fracking-induced earthquakes should cause voters to turnout to the polls and why this turnout should be greater for Democrats than Republicans. Next, I outline the data and em-

pirical approach I use to study the relationship between exposure to fracking-induced earthquakes and both election results and voter turnout. I then present a series of results indicating that voters are able to hold politicians accountable, and that this accountability comes via the mechanism of differential partisan turnout. Finally, I conclude with a few thoughts about the implications of these findings for American political behavior.

Fracking-Induced Earthquakes and Democratic Accountability

Amidst rising worries about the causes and consequences of global climate change, the 2020 presidential campaign season saw a notable discussion about the role of hydraulic fracturing (commonly known as "fracking") in the production of domestic energy. Speaking at the Vice Presidential debate in Salt Lake City, Utah, Republican candidate Mike Pence accused Joe Biden and Kamala Harris, the two candidates running on the Democratic ticket, of wanting to ban fracking throughout the country (Gonzales, 2020). Though Biden denied this claim multiple times in the days following the debate, his reluctance to ban fracking is increasingly at odds with the rank-and-file of the Democratic Party (Phillips, 2020).

As of 2016, one poll found that Democrats were thirty percentage points less likely than Republicans to support fracking.[1] After the emergence of congressional Democrats' calls for a "Green New Deal" designed to curb the effects of climate change, public opinion on fracking polarized further. Indeed, a 2019 study found that it is the most ideologically liberal and conservative individuals who hold the most polarized opinions on fracking. According to a report from the Pew Research Center, two-thirds of conservative Republicans support expanding fracking procedures while only 13% of liberal Democrats said the same. These trends, according to Pew, suggest a continuation of "[l]ong-standing political and ideological divides ... over support for expanding

[1]This poll, conducted via Gallup, can be found here: https://news.gallup.com/poll/190355/opposition-fracking-mounts.aspx.

fossil fuel energy sources, including . . . [fracking]" (Funk and Hefferon, 2019).

Fracking is polarizing, in part, because its consequences are readily felt. By injecting liquids into shale rock so that oil and natural gas can be extracted, the process of fracking can—and oftentimes does—produce "man made" earthquakes. Thus, Democrats who live in a state that relies heavily on the process are frequently exposed to a physical manifestation of a policy that they oppose. This exposure, I argue, should produce differential levels of turnout between Democrats and Republicans.

Oklahoma serves as a particularly useful test case for this theory. Since 2008, Oklahoma has seen a 900-fold increase in earthquakes. This increase has been almost entirely attributable to the growth of the natural gas industry in the state (Kuchment, 2019). And, while not all of the state's earthquakes are attributable to fracking itself, a significant portion are due to the related process of injecting and storing wastewater. Fracking, combined with the storage and disposal of wastewater, has precipitated an increase in earthquakes because these processes influence "the stability of fault zones deep underground" (Lewis, 2019). The result, according to a government-conducted study, is that the likelihood of experiencing an earthquake in Oklahoma that is sufficiently strong enough to cause damage is now "similar to the chance of damage caused by natural earthquakes at sites in parts of California" (U.S. Geological Survey, 2018). In fact, the amount of man-made earthquakes in the state are so great that, in 2016, Oklahoma had the most seismic activity in the continental United States (Jervis, 2016).

Rather than focusing on such a potential cause of voter turnout, prior work has largely focused on more instrumental reasons for showing up to the polls. Indeed, previous works argue that the decision to turn out to the polls is grounded in instrumental rationality. Classic arguments maintain that voters go to the polls when they feel their vote will be pivotal or they receive expressive benefits from doing so (Riker and Ordeshook, 1968). Others note that individuals are more likely to vote when they have the resources to do so (Brady, Verba and Schlozman, 1995), when they are mobilized by a party (Wielhouwer and Lockerbie, 1994), when it is easy to register (Leighley and

Nagler, 2013), or when motivated to do so by a descriptively representative candidate (Pomante and Schraufnagel, 2014).

However, it is possible that the stimulus one receives when experiencing the physical manifestation of an opposed policy can also predict voter turnout. Indeed, work in psychology suggests that unwanted stimuli usually prompt individuals to take an action or set of actions as a result of the experience. Thus, individuals who are angry might become more punitive (Lerner and Keltner, 2001) and those who are anxious might seek out information about the world (Albertson and Gadarian, 2015). In the same way, I expect those individuals who are opposed to fracking and are exposed to its physical manifestations—earthquakes—to be more likely to vote in an attempt to register their displeasure with the policy and its consequences. Thus, experiencing earthquakes should matter most for predicting voter turnout among Democrats.

Such a mechanism has grounding in the extant literature. Examining the effect of wind farm placement in Ontario, Stokes (2016) finds that the precinct-level vote share for the incumbent party decreased between $4 - 10\%$ when construction on a wind turbine was either proposed or a turbine was made operational. By eliciting opposition to a policy that has broad benefits but targeted costs, then, politicians can be punished at the ballot box. Such findings, Stokes (2016) argues, serve as "a reminder of the importance of examining a more diverse set of policy areas in political behavior and retrospective voting research."

More recent work argues that voters do not engage in blind retrospection in the wake of disasters wrought by natural phenomena. Instead, voters engage in "partisan retrospection" when assessing politicians and parties. Testing county-level support for presidents in the wake of various natural disasters, Heersink et al. (2020) find that counties that supported the president in the previous election reacted more positively to disaster responses than those counties that did not support the president.

This work builds upon these prior studies but differs from them in at least three important ways. First, unlike Stokes's (2016) contention that democratic accountability occurs through the

mechanism of changing minds (that is, classic retrospective voting), I argue that experiencing the physical manifestation of a disliked policy leads to democratic accountability by producing differential levels of partisan turnout—an argument I am able to test due to the unique nature of the natural experiment used in this study. Thus, democratic accountability is obtained by changing the composition of the voter pool and not by changing a voter's choice at the ballot box. Second, I present results suggesting that experiencing the physical manifestations of a disliked policy causes voters to punish parties not just at the local level. Consistent with the growing amount of nationalization in American politics (Hopkins, 2018), I find that higher levels of exposure to earthquakes also causes an increase in the Democratic Party's precinct-level vote share for presidential elections. And, finally, unlike previous studies on natural disasters and partisan retrospection (Heersink et al., 2020), I combine both precinct-level data and individual-level data in order to both avoid inferential problems and more precisely illustrate how democratic accountability can operate via the mechanism of differential partisan turnout.

Data & Methods

To examine the nature of democratic accountability, I rely on two sources of data pertaining to voters in Oklahoma. The first source of data is the Oklahoma voter file. The voter file was obtained via the L2 political and marketing company.[2] The voter file contains data on every registered voter in the state, including—among other things—information on each voter's partisan registration (options include Democrat, Republican, Libertarian, and non-partisan), their turnout history in both general and primary elections dating back to 2000, and basic demographic characteristics. Because the voter file does not contain a record of how any given individual voted, examining how

[2]More information about L2 can be obtained at www.l2political.com. The L2 file was obtained via Washington University in St. Louis. Due to licensing agreements, a limited version of the data can be found on the journal's website.

earthquake exposure shapes individual-level vote choice is not possible. However, understanding whether earthquake exposure predicts a better electoral result for Democrats is still possible. To do so, I merge the voter file data with precinct-level election results data from the Oklahoma Secretary of State.

With this data in hand, I rely on two primary dependent variables in this analysis. The first dependent variable captures the proportion of the two-party vote accruing to the Democratic candidate in each precinct during the 2016 general election. I examine the Democratic share of the two-party vote at the presidential level, for the contested Senate seat in Oklahoma in 2016, and for the contested races for the U.S. House of Representatives. In a later set of analyses, the dependent variable is an indicator for whether or not each registered voter turned out to vote in the 2016 general election. A value of 1 indicates that voter i turned out to vote; a value of 0 indicates that voter i did not vote in the 2016 general election. As this data is drawn from the voter file, the information is a validated measure of turnout and not one that relies on self-reports.

The primary independent variable throughout this paper is either a measure of each voter's overall earthquake exposure or an aggregated, precinct-level measure of earthquake exposure that draws on this individual-level variable. To create a measure of each voter's overall earthquake exposure, I draw upon the geolocation of each voter's home residence (from the Oklahoma voter file) and the geolocation of each earthquake's epicenter (as recorded by the USGS).[3] I first calculate the distance, in miles, between each voter i's home residence and the location of the epicenter of each earthquake j that occurred prior to the 2016 general election. This yields a $1,730,376 \times 4,885$ matrix. The distances contained in this matrix, denoted by d_{ji}, are then divided into the magnitude of each earthquake, denoted by m_j. Finally, I sum this calculation for each voter i to obtain an overall metric that captures how close and how powerful the pre-election earthquakes were to each

[3]Because I am interested in the relationship between earthquakes and voter turnout, I drop any earthquakes that occurred after the 2016 general election from the dataset (that is, any earthquakes that occurred on or after November 8, 2016).

voter. More formally, this measure is calculated as follows:

$$\text{Exposure} = \sum_{i=1}^{n} \frac{m_j}{d_{ji}} \tag{1}$$

where i indexes voters and j indexes earthquakes. Note that, because the distances d_{ji} are calculated between each voter and each pre-election earthquake that occurred throughout the state, this metric avoids any inferential problems that might arise due to calculating the number, or magnitude, of earthquakes at the county level. Higher scores indicate a greater amount of exposure to more powerful earthquakes. This measure ranges from an empirically observed minimum of 7.9 to an empirically observed maximum of $1,426.5$. The mean is 154.5 and the median is 125. For the purposes of empirical estimation, I scale this variable to range from 0-1.

Note that the data collected by the USGS contains information on *every* earthquake in the state, and data on the precise cause of any given earthquake is not available. Thus, it is likely that earthquakes that were not caused by fracking or fracking-related procedures (e.g. the storage of wastewater) are contained in this estimation. However, this is not problematic for at least two reasons. First, as noted above, the manifold increase in earthquakes in Oklahoma has been linked directly to the heightened activity of the natural gas industry. This suggests that a significant portion of the earthquakes in the data are, in fact, due to fracking or fracking-related procedures. Second, because fracking and the earthquakes it causes have become so politicized, voters are primed to think of earthquakes as being caused by fracking even when they are not. In terms of shaping voting behavior, the *belief* about the cause of an earthquake is just as, if not more, important than the *actual* cause.

Figure 1 shows the location of each pre-election earthquake that occurred in Oklahoma in 2016. While earthquakes occurred throughout the state, the majority of the epicenters were found in the central-to-north-central portion of the state. Because these epicenters appear to have a geographic clustering, it is likely that the location of an earthquake's epicenter is not distributed at random.

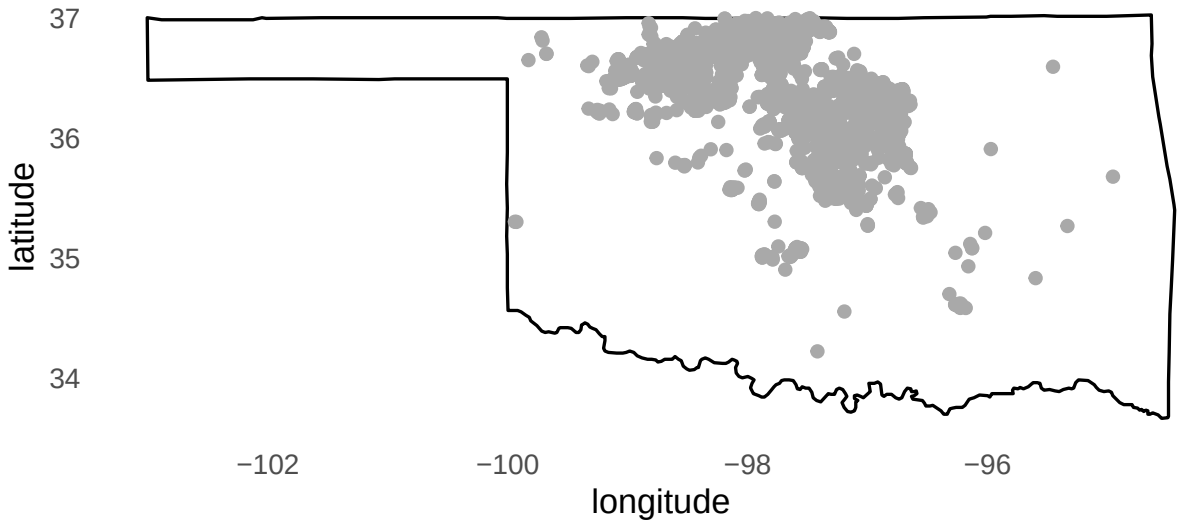

Figure 1: *Earthquakes in Oklahoma, 2016.* This figure shows the location of each pre-election earthquake in Oklahoma.

Nevertheless, there are reasons to assume that the exposure measure described above is plausibly assigned as-if random.

First, one can be exposed to an earthquake even if the earthquake occurred in a separate county. Indeed, aftershocks from an earthquake can be—and often are—felt multiple counties away. Thus, exposure to an earthquake can occur if an earthquake's aftershocks spill across state-delineated units and groupings. Empirically, this is true in the data used in this analysis. Individuals in each of Oklahoma's 77 counties had some degree of exposure to earthquakes. The mean county-level score on the exposure measure is 154; the standard deviation is 78.7 Moreover, with the inclusion of fixed effects for progressively smaller geographic units, it becomes more plausible that exposure to earthquakes is assigned as-if random.

This suggests that there are unlikely to be any selection effects determining an individuals' exposure to earthquakes. If individuals were moving throughout the state to avoid earthquakes, this would pose a threat for the inferences in this paper. However, as noted, residents in every county of the state were exposed to some degree of earthquakes. From an empirical standpoint, then, it is not possible to completely avoid exposure to earthquakes in the state. Moreover, recent research suggests that Americans primarily move to locations for job- or educational-related reasons (Martin and Webster, 2020; Mummolo and Nall, 2017). Such behavior is reflected in this data, with over 775 earthquakes occurring in the counties that make up the job-rich Oklahoma City metropolitan area. The fact that this many earthquake epicenters originated in the most populous area of the state suggests that individuals are not self-selecting into areas that experience fewer earthquakes.

The first set of analyses focuses on the effect of precinct-level earthquake exposure on the Democratic share of the two-party vote. Estimation is conducted via ordinary least squares (OLS)

regression. Formally, I estimate:

$$\text{Democratic Share}_j = \beta_1 \text{Mean Exposure}_j + \beta_2 \text{Prop. Democrat}_j + \beta_3 \text{Mean Exposure}_j \times \text{Prop. Democrat}_j + \gamma_j + \eta + \epsilon_j \quad (2)$$

where the dependent variable, Democratic Share$_j$, denotes the Democratic candidate's share of the two-party vote in precinct j. In various model specifications, this dependent variable measures the vote share for the Democratic presidential candidate, the Democratic Senatorial candidate, or the Democratic House candidate. The mean precinct-level earthquake exposure prior to the general election is denoted by β_1. This variable is scaled to range from 0-1. The relationship between the precinct-level Democratic vote share and the proportion of the precinct registered with the Democratic Party is denoted by β_2, while the interaction between mean earthquake exposure and precinct-level partisanship is captured by β_3. A series of control variables—including the proportion of the precinct that is female, the proportion of the precinct that is non-White, the proportion of the precinct that is married, and the mean household income—are contained in γ_i. Finally, η contains county-level fixed effects. Estimation is restricted to those who identify with either the Democratic or Republican Party. Conditional on the as-if random assumptions described above, the coefficients from the models estimated via Equation 2 take on a causal interpretation.

Results

Earthquakes and Election Results

The results of the regressions predicting the Democratic Party's precinct-level share of the two-party vote are shown in Table 1. In the first two specifications, I model the precinct-level Democratic vote share as a function of the mean precinct-level earthquake exposure (scaled to range from 0-1). Controls include the proportion of the precinct that is female, the proportion of the

precinct that is non-White, the proportion of the precinct that is Democratic, the proportion of the precinct's residents that are married, and the mean precinct-level household income. In the last two model specifications, I interact the mean precinct-level exposure variable with the proportion of the precinct that is registered with the Democratic Party to account for the fact that earthquake exposure might matter more in precincts that are more heavily Democratic. Two of the four model specifications contain county-level fixed effects and, in all cases, standard errors are clustered on the precinct.

	Proportion of Precinct-Level Democratic Vote (President)			
	(1)	(2)	(3)	(4)
Mean Exposure	0.127^{***}	0.056^{**}	-0.347^{***}	-0.064^{*}
	(0.014)	(0.026)	(0.043)	(0.038)
Prop. Female	0.317^{***}	-0.123^{*}	0.256^{**}	-0.123^{*}
	(0.117)	(0.069)	(0.122)	(0.072)
Prop. Non-White	0.731^{***}	0.444^{***}	0.593^{***}	0.426^{***}
	(0.024)	(0.027)	(0.030)	(0.030)
Prop. Democrat	0.213^{***}	0.543^{***}	0.007	0.449^{***}
	(0.024)	(0.033)	(0.028)	(0.038)
Prop. Married	-0.428^{***}	-0.428^{***}	-0.424^{***}	-0.428^{***}
	(0.038)	(0.032)	(0.035)	(0.032)
Mean Household Income	0.00000^{***}	0.00000^{***}	0.00000^{***}	0.00000^{***}
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Mean Exposure x Prop. Democrat			1.488^{***}	0.439^{***}
			(0.151)	(0.115)
Constant	-0.129^{*}		-0.006	
	(0.069)		(0.073)	
Fixed Effects:	None	County	None	County
N	1,931	1,931	1,931	1,931
R^2	0.689	0.874	0.725	0.876

$^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$

Table 1: *Precinct-Level Democratic Vote Share, President.* This table show the proportion of the two-party vote share accruing to the Democratic presidential candidate in 2016. In all models, standard errors are clustered on the precinct.

The results of the model shown in Column 1 indicate that moving from the lowest to the high-

est mean precinct-level earthquake exposure produces a nearly 13% increase in the precinct-level Democratic vote share. The inclusion of county-level fixed effects, as in Column 2, reduces the magnitude of this relationship. Nevertheless, exposure to earthquakes remains a significant predictor of the Democratic vote share. Indeed, even with county fixed effects included, moving from the lowest to the highest level of earthquake exposure predicts a 5.6% increase in the Democratic share of the two-party vote.

Columns 3 and 4 build upon these models by including an interaction term between the mean earthquake exposure variable and the variable measuring the proportion of Democrats in the county. In both Column 3 (without county fixed effects) and Column 4 (with county fixed effects) the relationship between mean earthquake exposure and the proportion of the Democratic two-party vote share is conditional upon the proportion of registered Democrats living in the precinct. In both specifications, the mean exposure variable is more strongly predictive of higher Democratic vote shares in precincts with a greater number of registered Democrats. Thus, in addition to being an unconditional predictor of higher vote shares for Democrats, exposure to earthquakes does more to increase the Democratic share of the two-party vote in precincts that are more heavily Democratic.

Because multiple races were contested during the 2016 general election, I also model the share of the precinct-level two-party vote accruing to the Democratic Senate candidate and the four Democratic candidates running for the House of Representatives.[4] For both of these races, the Democratic share of the two-party vote is modeled as a function of the same independent variables used to predict the Democratic vote share at the presidential level. The results of the models predicting the Democratic Senate candidate's precinct-level vote share are shown in Table 2; the models predicting the precinct-level vote share for the Democratic House candidates are shown in Table 3.

The results in Table 2 look quite similar to the results of the presidential vote share models. In Columns 1 & 2, the mean exposure variable is positive and significant. The results suggest that

[4]Oklahoma's 1^{st} congressional district, held by a Republican, was uncontested in 2016.

	Proportion of Precinct-Level Democratic Vote (Senate)			
	(1)	(2)	(3)	(4)
Mean Exposure	0.052^{***}	0.063^{***}	-0.234^{***}	-0.015
	(0.011)	(0.020)	(0.031)	(0.032)
Prop. Female	0.157^{*}	-0.202^{***}	0.120	-0.202^{***}
	(0.089)	(0.058)	(0.090)	(0.058)
Prop. Non-White	0.583^{***}	0.417^{***}	0.500^{***}	0.406^{***}
	(0.021)	(0.025)	(0.027)	(0.027)
Prop. Democrat	0.333^{***}	0.550^{***}	0.209^{***}	0.490^{***}
	(0.020)	(0.029)	(0.023)	(0.034)
Prop. Married	-0.350^{***}	-0.355^{***}	-0.348^{***}	-0.355^{***}
	(0.031)	(0.028)	(0.030)	(0.028)
Mean Household Income	0.00000^{***}	0.00000^{***}	0.00000^{***}	0.00000^{***}
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Mean Exposure x Prop. Democrat			0.899^{***}	0.280^{***}
			(0.105)	(0.091)
Constant	-0.040		0.034	
	(0.052)		(0.053)	
Fixed Effects:	None	County	None	County
N	1,931	1,931	1,931	1,931
R^2	0.730	0.882	0.747	0.883

$^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$

Table 2: *Precinct-Level Democratic Vote Share, Senate.* This table show the proportion of the two-party vote share accruing to the Democratic Senate candidate in 2016. In all models, standard errors are clustered on the precinct.

	Proportion of Precinct-Level Democratic Vote (House)			
	(1)	(2)	(3)	(4)
Mean Exposure	0.172^{***}	0.019	-0.233^{***}	-0.136^{***}
	(0.013)	(0.022)	(0.039)	(0.045)
Prop. Female	0.210^{*}	-0.125^{*}	0.167	-0.118^{*}
	(0.110)	(0.068)	(0.110)	(0.068)
Prop. Non-White	0.615^{***}	0.462^{***}	0.477^{***}	0.434^{***}
	(0.026)	(0.030)	(0.034)	(0.035)
Prop. Democrat	0.327^{***}	0.461^{***}	0.143^{***}	0.337^{***}
	(0.021)	(0.032)	(0.026)	(0.043)
Prop. Married	-0.289^{***}	-0.360^{***}	-0.294^{***}	-0.361^{***}
	(0.033)	(0.031)	(0.031)	(0.031)
Mean Household Income	0.00000^{***}	0.00000^{***}	0.00000^{***}	0.00000^{***}
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Mean Exposure x Prop. Democrat			1.248^{***}	0.524^{***}
			(0.134)	(0.133)
Constant	-0.103^{*}		0.001	
	(0.062)		(0.063)	
Fixed Effects:	None	County	None	County
N	1,609	1,609	1,609	1,609
R^2	0.705	0.866	0.742	0.869

$^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$

Table 3: *Precinct-Level Democratic Vote Share, House.* This table show the proportion of the two-party vote share accruing to the Democratic House of Representatives candidate in 2016. In all models, standard errors are clustered on the precinct.

moving from the lowest to the highest mean precinct-level earthquake exposure predicts anywhere from a $5.2 - 6.3\%$ increase in the Democratic Senate candidate's precinct-level vote share. And, as with the results shown in Table 1, the models in Column 3 & 4 indicate that the relationship between earthquake exposure and the Democratic share of the two-party vote is the strongest for those precincts that are the most Democratic.

The results of the models predicting the Democratic share of the two-party vote in House elections look substantively similar. The mean exposure variable is both positive and significant ($p < .01$) in the model without county-level fixed effects or an interaction term. However, the inclusion of county-level fixed effects produces a coefficient estimate for mean precinct-level earthquake exposure that is not statistically distinguishable from zero (Column 2). Importantly, however, the interaction term between mean earthquake exposure and the proportion of Democratic registrants in the precinct remains a statistically significant predictor of the Democratic candidate's vote share. This is the case whether county-level fixed effects are excluded (Column 3) or included (Column 4) in the model specification. Thus, as was the case with Presidential and Senate results, the relationship between earthquake exposure and the Democratic House candidate's vote share is strongest in those precincts with a greater proportion of registered Democrats.

Earthquakes and Voter Turnout

The results of the preceding regressions have shown that higher levels of earthquake exposure at the precinct level predict a greater share of the two-party vote for the Democratic candidate in Presidential, Senate, and House elections. Moreover, the results indicate that earthquake exposure is a stronger predictor of the Democratic candidate's vote share in precincts that have a greater proportion of individuals registered with the Democratic Party. However, these models are not able to speak to the mechanism driving the relationship between earthquake exposure and better Democratic electoral results. On the one hand, it is possible that these results are driven by voters changing their minds via retrospective evaluations of governmental performance (Stokes, 2016).

On the other hand, it could be the case—as I have argued—that voters are engaging in behavior that produces differential levels of partisan turnout. To determine whether democratic accountability can operate through this latter mechanism, I disaggregate the unit of analysis from the precinct to the individual. The ability to analyze individual-level data allows me to not only address the mechanism driving the results presented in this study; indeed, an individual-level analysis will also help to clarify the ways in which democratic accountability can operate in an era of partisan intransigence (Bafumi and Shapiro, 2009).

To better understand the mechanism driving the relationship between earthquake exposure and the Democratic candidate's vote share, I regress an indicator variable for whether or not an individual voted in the 2016 election. The primary independent variable of interest is the individual-level measure of earthquake exposure. I include control variables for each individual's gender, age, marital status, racial affiliation, partisanship, and estimated household income. Moreover, to determine whether the preceding results are being driven by differential partisan turnout, I also include an interaction between earthquake exposure and a dummy variable for Democrats. If the results in this study are driven by differential turnout, the interaction term between individual-level earthquake exposure and the dummy variable for Democrats should be significant and positive. If, however, the results are driven purely by retrospective evaluations leading to a change in voting decisions, then there should be no partisan difference in earthquake exposure and voter turnout.

The regressions predicting voter turnout as a function of earthquake exposure are shown in Table 4. Column 1 contains county-level fixed effects, while Columns 2 & 3 contain zip code-level fixed effects. The results in Column 1 indicate that those individuals who had greater exposure to earthquakes in 2016 were more likely to turn out to vote in the 2016 general election ($\beta_{\text{Exposure}} = .037$; $p < .05$). As was theoretically expected, the relationship between earthquake exposure and voter turnout is stronger for Democrats. Indeed, the interaction between the exposure measure and the dummy variable for Democrats is both positive and statistically significant ($\beta_{\text{Exposure}\times\text{Democrat}} = .101$; $p < .01$).

One concern with the results presented in Column 1 of Table 4 is that they contain fixed effects on a relatively large geographic area. While county-level fixed effects allow for significant variation in the exposure measure, they potentially allow for plenty of unobserved characteristics to remain unaccounted for in the empirical estimation. To address this concern, Columns 2 & 3 contain fixed effects at the zip code-level. This removes much of the within-geography variation in the

	Turnout in 2016		
	(1)	(2)	(3)
Exposure	0.037**	0.037	0.013
	(0.016)	(0.030)	(0.030)
Democrat	0.00000***	0.00000***	0.00000***
	(0.000)	(0.000)	(0.000)
Exposure X Democrat	0.101***		0.085***
	(0.013)		(0.013)
Fixed Effects:	County	Zip Code	Zip Code
Clustered SEs:	Individual	Individual	Individual
N	1,379,425	1,379,425	1,379,425
R^2	0.101	0.103	0.103

*p < .1; **p < .05; ***p < .01

Table 4: *Earthquake Exposure and Individual Turnout, 2016.* This table shows individual-level turnout in the 2016 general election in Oklahoma as a function of earthquake exposure. County-level or zip code-level fixed effects are included in all model specifications. Individuals who registered as non-partisan or Libertarian are dropped from the analysis. Control variables are included in all specifications but are not shown.

exposure measure; however, it accounts for more of the unobserved characteristics that might be biasing the coefficients derived from the empirical estimation (for example, economic conditions or some cultural tastes that encourage or discourage voter participation).

To begin, Column 2 presents results from a model of individual-level turnout with no interaction between the exposure measure and the dummy variable for Democrats. The results from this model suggest that there is no relationship between earthquake exposure and voter turnout. However, the results from the model shown in Column 3—which contains an interaction be-

tween earthquake exposure and registered Democrats—presents a more nuanced picture. Here, the exposure measure remains a statistically insignificant predictor of voter turnout. However, the interaction term between earthquake exposure and Democrats is both positive and statistically significant. This indicates that the relationship between earthquake exposure and voter turnout is entirely dependent on the voter's partisan affiliation. A greater exposure to earthquakes increases the likelihood that a registered voter casts a vote but *only* if the voter is registered as a Democrat ($\beta_{\text{Exposure}\times\text{Democrat}} = .085$; $p < .01$). Taken together, the results of the models shown in Columns 2 & 3 reveal that the variation in voter turnout due to earthquake exposure is a function of a voter's partisanship. Democratic accountability, then, is operating via the mechanism of differential partisan turnout.

While the results in Table 4 indicate that greater exposure to earthquakes is predictive of turning out to vote, and that this relationship is stronger for Democrats, these results do not address the nature of temporal changes in exposure to earthquakes. In fact, it is possible that exposure to earthquakes matters most for voter turnout when an individual's exposure has increased over time. To examine whether this is the case, I incorporate data on voter turnout and earthquake exposure in the lead up to the 2012 general election.

First, I calculated each individual's pre-election earthquake exposure score in 2012. These scores were calculated using the same method used to derive exposure scores in 2016, as described above. With these measures in hand, I specify a saturated model of voter turnout in 2016 with measures of earthquake exposure (once again scaled to range from 0-1), a dummy variable for the year 2016, and a dummy variable for those who are registered with the Democratic Party. Because it is fully saturated, the model also includes each of the pairwise interactions as well as the triple interaction. This triple interaction—that is, the interaction between exposure, time, and a Democratic partisan registration—is the coefficient of interest. Across the four model specifications, I include different fixed effects. In Column 1, no fixed effects are included. In Columns 2-4, I include county-, zip code-, and precinct-level fixed effects, respectively. In all cases, the standard

errors are clustered on the voter's precinct. These results are displayed in Table 5. Note that this empirical estimation is analogous to a difference-in-difference-in-differences design. However, causal identification in this case would require earthquakes to have had no effect on voter turnout in 2012. Because this is unlikely to be the case, the results presented below are best interpreted as the relationship between the change in 2012 to 2016 exposure and voter turnout.

	Turnout in 2016			
	(1)	(2)	(3)	(4)
Exposure	0.277^{***}	0.560^{***}	0.304^{***}	0.293^{***}
	(0.084)	(0.097)	(0.075)	(0.066)
2016	0.124^{***}	0.130^{***}	0.134^{***}	0.135^{***}
	(0.002)	(0.003)	(0.002)	(0.002)
Democrat	0.002	0.011^{***}	0.017^{***}	0.024^{***}
	(0.004)	(0.004)	(0.003)	(0.003)
Exposure x 2016	-0.111	-0.388^{***}	-0.221^{***}	-0.222^{***}
	(0.076)	(0.082)	(0.068)	(0.061)
Exposure x Democrat	-0.509^{***}	-0.683^{***}	-0.639^{***}	-0.652^{***}
	(0.131)	(0.138)	(0.124)	(0.123)
2016 x Democrat	-0.055^{***}	-0.053^{***}	-0.056^{***}	-0.057^{***}
	(0.004)	(0.004)	(0.004)	(0.003)
Exposure x 2016 x Democrat	0.441^{***}	0.558^{***}	0.540^{***}	0.556^{***}
	(0.128)	(0.135)	(0.123)	(0.122)
Constant	0.652^{***}			
	(0.003)			
Fixed Effects:	None	County	Zip Code	Precinct
N	2,938,172	2,938,172	2,938,172	2,938,172
R^2	0.018	0.021	0.027	0.035

$^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$

Table 5: *Change in Earthquake Exposure.* This table shows the relationship between the change in earthquake exposure between 2012 and 2016 and voter turnout. In all specifications, standard errors are clustered at the precinct level.

Column 1 shows results from the least restrictive specification of this model. Here, the results suggest that an increase in earthquake exposure from 2012 to 2016 increases the likelihood that Democrats will turn out to vote ($\beta_{\text{Exposure}\times 2016\times \text{Democrat}} = .441$; $p < .01$). When fixed effects

for an individual's county of residence are included, the magnitude of this coefficient increases ($\beta_{\text{Exposure}\times 2016\times \text{Democrat}} = .558$; $p < .01$). However, as with the results shown in Table 4, the inclusion of county-level fixed effects still allows for plenty of unobserved characteristics to bias the coefficient estimates. To this end, Columns 3 & 4 include fixed effects for progressively smaller geographic areas. With the inclusion of zip code-level fixed effects (Column 3) the results change very little. Indeed, the triple interaction remains positive and statistically significant ($\beta_{\text{Exposure}\times 2016\times \text{Democrat}} = .540$; $p < .01$). Finally, the inclusion of precinct-level fixed effects (Column 4) does nothing to change the substance of the main empirical finding: Democrats who saw an increase in their exposure to earthquakes between 2012 and 2016 were more likely to turnout to vote ($\beta_{\text{Exposure}\times 2016\times \text{Democrat}} = .556$; $p < .01$).

These results indicate that democratic accountability can—and does—operate through the mechanism of differential partisan turnout. Indeed, in all of the model specifications displayed above, the interaction between earthquake exposure and a dummy variable for being registered with the Democratic Party is both positive and statistically distinguishable from zero. Moreover, these results persist regardless of whether individual-level turnout is examined cross-sectionally, as in Table 4, or longitudinally, as in Table 5. By being exposed to the physical manifestations of a disliked policy, Democratic voters are registering their displeasure with the governing party by turning out to vote in greater numbers.

Conclusion & Implications

The preceding results have shown that voters are able to engage in the crucial process of holding their elected officials accountable for their governing choices. Utilizing a natural experiment on over 1.3 million registered voters that has different theoretical expectations for Democrats and Republicans—exposure to fracking-induced earthquakes—I have demonstrated that precincts with higher levels of aggregate earthquake exposure give a greater share of their vote to Democratic

candidates. This relationship is most pronounced for those precincts that have a large proportion of registered Democrats. Crucially, however, I have shown that this form of democratic accountability operates via the mechanism of differential partisan turnout. While the results of this study do not dismiss the possibility that voters still engage in retrospective evaluations when making their choices at the ballot box, they do suggest something unique about the nature of accountability in the contemporary era of politics. Indeed, democratic accountability in a polarized age appears to be driven by differential levels of partisan turnout. Exposure to earthquakes matters most and, in some cases, only for those individuals who are registered with the Democratic Party.

One limitation of the present study is that it focuses on an issue that is particularly salient to one side of the contemporary political divide. Though there is no *ex ante* reason to assume that a similar mechanism would not be at work for Republicans, an explicit test of this assumption is likely to be a fruitful area for future research. With politics becoming increasingly divided along multiple lines, and partisans becoming more likely to vote straight-ticket (Jacobson, 2015), the opportunities for studying Republicans' reactions to the physical manifestations of an unliked policy are vast.

Additionally, future work should consider the nature of democratic accountability in local elections. Though national politics is often the recipient of greater scholarly focus, it nevertheless remains true that much of the governing in the United States occurs at local levels. Because local politics is often conducted without partisan labels, partisanship may be less salient of a guide outside of federal elections (c.f., de Benedictis-Kessner and Warshaw, 2016). Accordingly, it is possible that accountability at the local level operates under the mechanism of retrospective evaluations instead of differential levels of partisan turnout. Understanding the differences between accountability at the national and local levels is both an important and promising area for future research.

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