Local Economic Shocks and Political Participation: Evidence from the US Shale Boom*

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Abstract

While changes in the local economy have been shown to affect political elites and aggregate election outcomes, there is little empirical evidence about how these shocks affect individual voters. We argue that even positive economic shocks can have heterogeneous effects on political participation, depending on a group's exposure to negative externalities. To test these claims, we study the shale gas boom in the United States. Combining zip code-level data on the presence of fracking wells with individual-level data on participation, we find that fracking decreases voter turnout but increases campaign contributions. We examine potential mechanisms that explain the turnout result and find that educational attainment declined while drug-related deaths increased in fracking areas. The negative impacts on turnout are concentrated among liberal voters, while the positive impacts on contributions redound mainly to Republican candidates. Thus, a uniformly positive income shock can have substantially unequal consequences for political participation.

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1 Introduction

The economy is clearly consequential for politics. At the most fundamental level, economic performance translates into rewards or punishment for political incumbents (Healy and Lenz 2017). Positive economic shocks can also decrease voters' preferences for redistribution (Brunner, Ross, and Washington 2011), while negative shocks can lead to demands for policy responsiveness (Feigenbaum and Hall 2015) or more extreme candidates (Autor et al. 2017; Dippel, Gold, and Heblich 2015). These political outcomes then lead to policy choices, ultimately shaping future economic outcomes.

While political scientists have studied the effect of local economic changes on elite behavior and aggregate election outcomes, we lack a clear theoretical or empirical understanding of how the local economy impacts individual voters. This is an important omission for at least two reasons. First, changes in individual behavior are clearly important mechanisms for the aggregate effects that others have found. Second, and more importantly, a focus on aggregate outcomes obscures the distributional consequences that typically accompany economic change.

We study the impact of local economic shocks on individual political participation. It is well-documented that affluent citizens are more likely to participate in politics than those who are less affluent (Verba, Schlozman, and Brady 1995). So robust is the participation-income relationship that Bartels (2008) describes "the disparity between rich and poor citizens in political participation" as "unusually well-documented." This may imply that, all else equal, increases in income and employment should increase political participation. In practice, however, economic shocks are typically accompanied by politically relevant externalities that could have countervailing effects. For instance, if employment growth is limited to low-skilled labor, this may negatively impact educational attainment among this group. With these considerations in mind, we expect the impact of economic change to vary depending on a group's exposure to negative externalities.

Empirically, we test our argument using the case of the shale gas boom in the United States. The technological innovation known as "fracking" created a natural resource boom in many areas of the country, and the positive impact of fracking on wages and employment is now extensively documented. One published estimate suggests a gain of $35,000 for every one million dollars of new production. This wealth effect is not limited to the energy sector, but extends to manufacturing and service sector workers (Feyrer, Mansur, and Sacerdote 2017; Allcott and Keniston 2018).

In addition to its utility as an "instrument" for positive income changes, there is another reason why examining the effect of income changes on political participation through the case of fracking in the US is interesting. Unlike individual-level wage growth and employment status or winning a lottery, fracking is also reported to bring numerous social and demographic changes in to the community. For example, studies document that increased demand for labor and higher wages in fracking areas affect individuals' incentive to stay in school (Cascio and Narayan 2015; Marchand and Weber 2015). As concerns about the environmental impact of fracking have risen (Healy 2015), fracking has become such a salient contemporary political issue (Gabriel and Davenport 2016) that demand for environmental protection and conservation has increased at the local level. 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. By exploring changes induced by income changes in fracking areas, we provide a tighter link between local economic shocks and 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 2000 and 2016. We combine this information with individual-level data on voter turnout and campaign contributions. Using a difference in differences design, we find effects that vary in a manner consistent with theoretical predictions. The shale boom causes a drop in voter turnout, a participatory act that is the most common and the least unequal. Yet it also causes an increase in campaign contributions, an act that is concentrated among high-income voters who are likely shielded from the boom's negative externalities.

To further explore the predicted mechanism, we conduct two additional sets of analyses. First, we perform a series of "long-difference" regressions at the county level to test directly for impacts on externalities. We find that while fracking increases income and decreases unemployment, it also decreases political competition and the share with a college degree. Changes in labor market demand are associated with declines in educational attainment in fracking areas (Marchand and Weber 2015). Fracking provides an interesting case where individuals' income increases but educational attainment goes down. Given that the existing literature documents a powerful effect of education on turnout (e.g., Wonfinger and Rosenstone 1980; Sondheimer and Green 2010; Smets and van Ham 2013), the significant drops in education levels in fracking areas seem to explain the turnout decline. We also find that drug-related deaths have increased sharply in fracking areas. Combined, our analyses suggest that decreased educational attainment and the increased drug use in fracking areas – despite significant increases in income and employment – lead to lower turnout in those communities.

Second, we return to the individual-level data and test for heterogeneous effects by political ideology. We find that, while overall turnout declined in fracking areas, the effects are larger among more liberal voters. In terms of campaign contributions, although individuals and PACs both increased their contributions to state and federal candidates, the impact by party is restricted to Republicans. Individual donor-level analysis shows that after fracking booms, donors reduced their contributions to Democratic candidates, and any new donors mainly donated to Republican candidates.

Using detailed data on shale gas development at the zip code-level, this paper provides systematic analysis of the effect of local economic shocks on political participation. Our results show that economic shocks – even positive shocks – can have unequal effects on the political participation of different groups. Importantly, these differences in participation may then feed back into the policy process, lessening the chances for substantive policy changes to equitably address economic changes. In particular, policies developed in response to economic changes – in our case, the shale boom – may be biased toward high-income and conservative voters, given that low-income and liberal voters are more likely to be demobilized by these changes.

Our paper complements two existing studies examining the political effects of the shale boom in particular. First, Cooper, Kim, and Urpelainen (2018) show US House members from shale areas become less environmentally friendly in response to the boom. Second, Fedaseyeu, Gilje, and Strahan (2018) find Republican candidates in presidential, congressional, and state gubernatorial races gain substantial support due to fracking booms. By focusing on micro-level voter behavior, we identify changes in political participation as a possible mechanism for these aggregate results.

Our findings also add to our knowledge of how resource booms affect politics (e.g., Ross 2001; Haber and Menaldo 2011). 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 is elected to power (Monteiro and Ferraz 2012; Carreri and Dube 2017). By highlighting heterogeneous effects of resource booms on political participation by exposure to negative externalities and by ideology of individuals, we provide a micro-foundation for how natural resource booms affect political outcomes.

2 Economic Resources and Political Participation

Scholars have spent copious amounts of time studying why people participate in politics. Among all the factors considered, income and economic resources are thought to be among the most important (Wonfinger and Rosenstone 1980; Verba and Nie 1987; Verba, Schlozman, and Brady 1995; Leighley and Nagler 2013). As Verba, Schlozman, and Brady (1995) explain, "study after study in the United States and elsewhere confirms that those who are advantaged in socioeconomic terms – who have higher levels of education, income, and occupation – are more likely to be politically active" (19). As these and other authors have shown, economic resources are strong predictors of voting, donating to campaigns, and other participatory behaviors.

Although there is a clear participatory gap between income groups, it is not clear whether increases in wages or wealth *cause* more political participation, since individuals with different incomes are also different in many other dimensions that could affect the likelihood of participation in the political process. Most of the evidence for the relationship between income and political participation comes from cross-sectional comparisons, which can reflect selection bias. Therefore, it is not clear whether an increase in incomes would lead to an increase in political participation.

The few existing studies on the causal effect of income on turnout present mixed results. Charles and Stephens (2013) find that higher local wages and employment lowers turnout in midterm elections but not presidential elections. They suggest that increased employment lowers media usage and political knowledge that could be conducive to higher turnout. On the other hand, Akee et al. (2018) study how unconditional cash transfers to American Indians in rural western North Carolina effect turnout. They find that income transfers significantly increased turnout levels of children in the initially poorer families and suggest that an increased likelihood of children completing high school on time could be a potential mechanism for a positive outcome on turnout. The existing literature suggests that the way income changes induce individuals' time usage and educational attainment is an important mechanism that drives the relationship between income increases and turnout. Apparently, the effect of income increases on turnout critically hinges on what individuals do with those increases in income at the individual level.

Research on positive income and wealth shocks also examines outcomes other than turnout. Individuals who benefit from lotteries or oil price increases tend to increase support for incumbent politicians (Wolfers 2007; Bagues and Berta 2016). Studies also examine the effect of unexpected fortunes on attitudes toward redistribution. Doherty, Gerber, and Green (2006) find that lottery winners became more negative toward estate taxes and redistribution programs, and Brunner, Ross, and Washington (2011) find positive economic shocks decreased support for redistributive policies among California voters.

Studying the connection between income increases and political participation using shale gas booms is particularly useful in finding the underlying mechanism driving this relationships. Oil and gas booms generated positive income shocks in many areas of the US, which resulted in significant consequences in local labor markets. Fracking brought growth in wages and employment (Allcott and Keniston 2018; Feyrer, Mansur, and Sacerdote 2017), and changes in property values (Muehlenbachs, Spiller, and Timmins 2015), as well as liquidity inflows to banks and increased mortgage lending (Gilje, Loutskina, and Strahan 2016).

Yet, fracking-induced income changes in the US are different from pure windfalls or cash transfers from governments, as studies have documented numerous externalities produced by shale gas booms. Cascio and Narayan (2015) document that due to increased demand for low-skilled labor, fracking leads to lower high school completion rates among male teenagers. Marchand and Weber (2015) also show that higher wages in fracking areas attract vocationally and economically disadvantaged students into the labor market. This suggests that educational attainment could decrease in fracking areas, despite increases in income and wealth. These changes in labor market demand could induce migration of young and less-educated males to fracking sites. For example, North Dakota has experienced significant short-term population growth due to its fracking boom (Wilson 2016). Migration patterns can change the composition of local demographics and this could also lead to changes in patterns of political participation.

Although incomes and wealth generally increase in fracking areas, media also report that royalty payments are often concentrated on a few landowners (Cusick and Sisk 2018). This disparity could lead to increases in income inequality in the shale-affected areas. Some existing research suggests that income inequality is correlated with lower voter turnout and less political participation overall (Galbraith and Hale 2008; Solt 2008). Alcohol problems in booming towns and drug traffic using roads created for shale gas development are also 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 important implications for political participation.

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. 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 raise concerns about the environmental effects of fracking. Starkly different opinions about fracking correspond with partisan affiliations: according to Gallup, 55% of Republicans, but just 25% of Democrats, supported fracking in 2016.[1]

As the concerns that shale development could cause increased earthquakes and water contaminations increase, some members of Congress have introduced bills implementing regulations on shale gas development at the federal level, but those efforts are countered by energy industries and legislators who support fracking. A *New York Times* article that identified types of megadonors for the 2016 presidential campaign listed "The Frackers," those who accumulated enormous fortunes from energy booms, as the first 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.

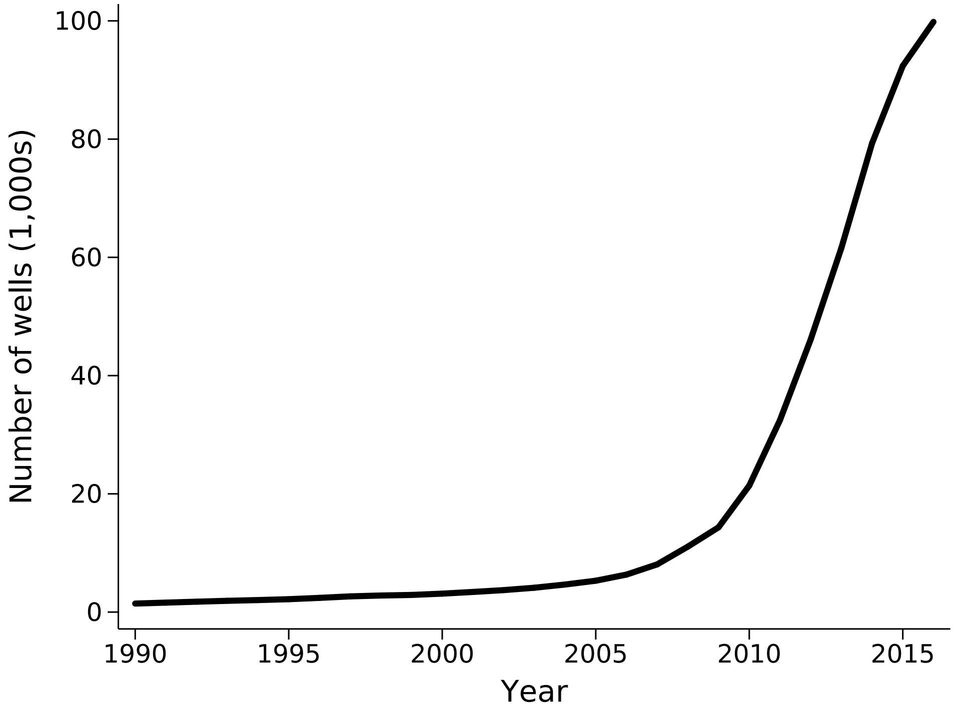
3 Data

Shale gas refers to natural gas that is produced from organic shale formations. The US has experienced an extraordinary shale gas boom over the last fifteen years. Shale gas accounted for only 1.6% of total US natural gas production in 2004, but that number rose to 23.1% in 2010. The technological innovations of hydraulic fracturing and horizontal drilling made shale gas extraction viable. Hydraulic fracturing, informally referred to as "fracking," is an oil and gas-well development process that typically involves injecting water, sand, and chemicals under high pressure into a bedrock formation via the well. 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, this technological innovation has dramatically increased the number of horizontal or "fracking" wells since the 1990s, and especially since around 2004.

We collect oil and gas production data at the individual well-level from 1990 to 2016 from Drillinginfo.com, an energy information service firm. Drillinginfo.com provides well-level oil and gas production data in detail for each month, allowing us to can match the wells' locations with their zip codes. It provides the number of reported producing wells and indicates whether a property was drilled horizontally or vertically. Following Fedaseyeu, Gilje, and Strahan (2018),

[1] http://www.gallup.com/poll/190355/opposition-fracking-mounts.aspx

Figure 1: Horizontal gas wells (in 1000's) by year, 1990-2016.



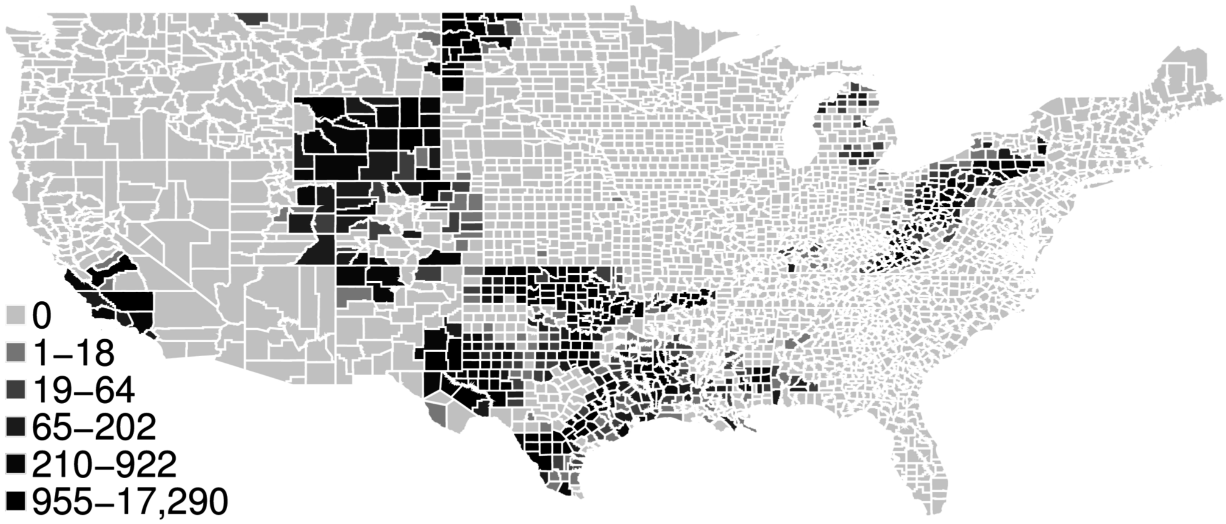
we use the Drillinginfo.com data to construct a measure of the total number of horizontal wells in a given geographic area in a given year.[2]

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

We examine turnout in presidential elections between 2000 and 2016. To examine the fracking boom's impact on individual-level voting behavior, we employ data from Catalist LLC. Catalist is a data vendor that collects various types of information on registered voters and provides datasets to the Democratic party and liberal organizations (Ansolabehere and Hersh 2012). Catalist provides "analytical samples" that comprise 1 percent of all individuals in Catalist's database to academic

[2] We obtained a list of wells that included their geographic coordinates and year of first operation. We assume that once a well opens, it remains open.

Figure 2: Cumulative number of horizontal wells by county, 1990-2016



institutions (Hersh 2015).[3] The sample includes information on 3.2 million individuals from all 50 states, including turnout and registration history back to 2000. Therefore, we were able to merge fracking well information to each individual at the zip code-level.

To study campaign contribution behavior, we use the Database on Ideology, Money in Politics, and Elections: Public version 2.0 (`DIME`) for campaign contributions for the period from 2004 to 2014 (Bonica 2016). Each row in the original dataset is a contribution made by an individual or an organization in a given election cycle. We aggregate contributions data to the zip code-level by summing each donation within the given zip code of the contributor.

4 The Effect of Fracking on Voter Turnout

First, we examine the effect of shale gas booms on turnout. Given the panel structure of our data, the natural estimation strategy is a difference in differences regression with year and zip code fixed effects, and errors clustered by zip code:

$$turnout_{ijt} = \alpha + \beta * fracking_{jt} + zipcode_j + year_t + \varepsilon_{ijt} \quad (1)$$

[3]We obtained this 1% sample through the New York University library system on August 15, 2018.

In this regression, i indexes individuals, j indexes zip codes, t indexes years, and $turnout_{ijt}$ is equal to 1 if an individual was both eligible to vote and voted in the election at time t, and 0 if they were eligible but did not vote. Those who were ineligible to vote (i.e., not registered at the time of the election) are coded as missing.

Because the distribution of horizontal wells is highly skewed, we use three measures of fracking activity. First, we use the raw number of wells in a zip code. Second, we use the log number of wells, plus one. Third, we use a dummy variable equal to 1 if a zipcode has any horizontal wells at time t, and 0 otherwise.

A separate issue is the presence of high serial correlation in our data, which increases the risk of false positives (Bertrand, Duflo, and Mullainathan 2004). For instance, 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 (and the one-year lag is correlated at 0.99). Later in the paper, we implement a "long-difference" specification at the county-level that addresses this issue (Bertrand, Duflo, and Mullainathan 2004).

Aside from inference, our design relies on the assumption that areas that experienced fracking would have had similar outcomes to areas that did not, if fracking areas had not experienced fracking. In other words, we require that fracking be "quasi-random." As a check on this assumption, we present results from specifications with interactions between fracking activity and year indicators. We generate a variable "Frack" equal to 1 if a zip code ever had any horizontal wells over the sample period, and 0 otherwise. We then include separate interactions between "Frack" and each year of the data, except the first year (2000 for the turnout data).[4] If we find significant interactions before the fracking revolution, which began around 2005, this would cast doubt on the interpretation of our estimates as causal effects.

Table 1 presents the results. Note that we rescale the turnout variable to be either 0 or 100 for presentation purposes. The estimate in column (1) suggests that as a zip code gains an additional fracking well, turnout declines by 0.02. The effect is precisely estimated, and significantly different

[4] The "main effect" of the "Frack" variable is perfectly collinear with the zip code fixed effect, and so is omitted.

	All States				High-Fracking States			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wells	-0.02***				-0.01**			
	(0.00)				(0.00)			
Log wells		-2.08***				-0.80**		
		(0.27)				(0.29)		
Any wells			-4.90***				-1.88*	
			(0.61)				(0.74)	
Frack X 2004				0.24				-0.33
				(0.42)				(0.63)
Frack X 2008				-2.35***				-3.47***
				(0.55)				(0.84)
Frack X 2012				-2.47***				-4.78***
				(0.63)				(0.96)
Frack X 2016				-9.07***				-4.31***
				(0.84)				(1.17)

Table 1: The effect of fracking booms on voter turnout. Cell entries are regression coefficients with zip code-clustered standard errors in parentheses. The dependent variable is a binary indicator for turning out to vote, rescaled to 0 or 100 for presentational purposes. All specifications include election and zip code fixed effects. * p<0.05, ** p<0.01, *** p<0.001.

from zero at the 0.001 level.[5]

Column (2) presents estimates using the log number of wells in a zip code. Here the estimate is -2.08, with a standard error of 0.27. This estimate tells us that as the number of wells increases by one percent, the probability a voter turns out declines by 2.08/100 = 0.028 on a one hundred point scale.

In column (3), we use an indicator for whether a zip code has any horizontal wells, or not (i.e., we treat zip codes with few and many wells equally). Here the point estimate is -4.9, with a standard error of 0.6. When fracking begins in a zip code's area, individuals in that area become roughly five percentage points less likely to vote, relative to the change in turnout in zip code areas where fracking does not begin during the same period.

[5]While seemingly small – i.e., a voter with a 60% probability of voting becomes 59.09% likely to vote when a well appears – the actual substantive effect depends on the number of wells in a "typical" fracking zip code. In 2008, among zip codes with any active wells, the average number of wells was about 10.6, with a standard deviation of 30. Therefore, the substantive impact could therefore be around 0.6 percentage points, according to this specification.

Column (4) presents estimates from the model with interactions between "Frack" – that is, whether a zip code experienced any fracking over the entire sample period – and election year indicators. Reassuringly, there is no evidence that turnout was declining prior to the fracking boom period. The estimate on the first interaction is 0.24, with a standard error of 0.42, indicating that relative to turnout in 2000, voters in fracking zip codes did not change the frequency of their turnout more or less than voters in other zip codes. In contrast, the interactions with the post-boom elections are uniformly negative.

To test the robustness of these results, columns (5) through (8) replicate the analysis, but focuse on 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. On the other hand, focusing on seven states significantly reduces our sample size, and also reduces variation in the fracking variable given potential spillovers within states. In practice, we find similar estimates in these states, though the effect sizes are smaller and less precisely estimated. For instance, we find that voters in zip codes with any horizontal wells become about two percentage points less likely to vote, relative to the changes experienced by voters in non-fracking zip codes in these states (column (7)).

5 The Effect of Fracking on Campaign Contributions

Next, we examine the impact of fracking on political contributions. The existing research suggests that substantial economic shocks could have profound effects on voters' preferences for candidates and attitudes toward redistribution. Given fracking's impact on income and wealth, it is plausible that fracking-related individuals and groups change their political behaviors. For example, the average shale county in Pennsylvania, which is a part of the Marcellus Shale, has experienced a 9% increase in personal income and a 24% increase in business income relative to non-shale counties (Fedaseyeu, Gilje, and Strahan 2018).

Among many forms of political participation, the effect of sharp increases in income on campaign contributions has received much media attention. For example, *The New York Times* reports that Dan and Farris Wilkis, "abortion opponents whose trucking and equipment business struck gold in the fracking boom," contribute millions of dollars to politics, almost exclusively to Republican candidates (Lichtblau and Confessore 2015). Shale gas booms have brought fortunes to both individuals and firms.

Table 2 shows the results using the logged sum of total individual contributions (plus one) per zip code as the outcome, using the same specifications employed in our turnout analysis. Again, we use several measures of fracking activity, and we multiply logged contributions by one hundred to ease interpretation. In column (1), we see that the raw number of wells and total giving are positively related: the point estimate is 0.27, with a standard error of 0.05. Given the scale of the outcome, this estimate implies that for each additional well, total contributions increased by 0.27 percent.[6]

In column (2), we use the log number of wells as the key predictor. Here the coefficient is 9.6, with a standard error of 1.86, therefore highly precise. Thus, for every one percent increase in the number of wells, total contributions increase by about a tenth of a percent.[7] In column (3), the estimate is 9.42 with a standard error of 4.8, suggesting that zip codes with any fracking see, again, about a tenth of a percent increase in total contributions.

Turning to the dynamic specification in column (4), zip codes that ever experienced fracking are not appreciably different in their contributions until 2006, when there is actually a negative difference of 15.33 (standard error of 6.14). Perhaps, this reflects the 2006 election's status as a "wave election" for Democrats, and the tendency of areas with fracking to vote Republican. In any case, the difference works against us finding a positive effect in the post-fracking era, and the remaining coefficients show more consistently positive impacts in 2012 and 2014.

Columns (5) through (8) repeat the analysis, but only use the seven high-fracking states. In

[6] In a typical log-level regression, a one-unit change in x is said to increase y by $100^*\beta$ percent. Given we have already multiplied the log contributions by one hundred, in our case it is simply β percent.

[7] If log contributions were not multiplied by one hundred, the coefficient would be 0.096, or about 0.1.

	All States				High-Fracking States			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wells	0.27***				0.27***			
	(0.05)				(0.05)			
Log wells		9.60***				10.36***		
		(1.86)				(2.16)		
Any wells			9.42*				7.62	
			(4.48)				(5.50)	
Frack X 2002				4.15				6.55
				(5.72)				(7.85)
Frack X 2004				9.23				14.72
				(5.84)				(8.07)
Frack X 2006				-15.33*				2.27
				(6.14)				(8.45)
Frack X 2008				0.64				17.12*
				(6.09)				(8.41)
Frack X 2010				4.14				24.94**
				(6.29)				(8.60)
Frack X 2012				14.08*				22.45**
				(6.23)				(8.64)
Frack X 2014				16.48*				26.76**
				(6.74)				(9.31)

Table 2: The effect of fracking booms on campaign contributions. Cell entries are regression coefficients with zip code-clustered standard errors in parentheses. The dependent variable is logged total individual contributions in a zip code, plus 1, multiplied by 100 for presentational purposes. All specifications include election and zip code fixed effects. * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

contrast to the turnout regressions, restricting the sample in this way for contributions does not appreciably affect the magnitude or precision of the estimates. Notably, the “Any wells” dummy is now statistically insignificant (the estimate is 7.62 with an error of 5.5). Also notably, restricting the sample in this way appears to alleviate any differential pre-trending due to the 2006 election, and increases the magnitude of the post-boom interactions considerably.

6 Potential Mechanisms

In light of past research, it is intuitive that campaign contributions should 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 turnout. In this section, we analyze a "long panel" of county-level outcomes to explore potential mechanisms for our results. In so doing, we provide further evidence that the results presented in the previous section are robust.

Because the fracking boom began around 2005, we compare outcomes between 2000 (pre-fracking) and 2010 or 2012 (post-fracking), depending on data availability. We examine differences in means on a set of relevant variables between fracking and non-fracking counties in the pre-period, the post-period, and the difference in the two differences. For this analysis, we code a county as "fracking" if it had zero horizontal wells in 2000, but one or more horizontal wells in 2010.

Table 3 presents the results, starting with all states in the top panel. We begin with voter turnout. Given turnout and wells are highly serially correlated, this analysis shows that our results are robust to a "long differences" comparison that addresses this issue. Here, we see that even before fracking occurs (2000), turnout in fracking counties is 3.6 percentage points lower than turnout in non-fracking counties. However, after fracking (2012), this difference rises to 7.02 points, for an overall difference in differences of -3.41 (standard error of 0.35).

We next examine two other political variables. First, several recent studies find that fracking leads to more conservative voters (Fedaseyeu, Gilje, and Strahan 2018) and, in turn, more conservative politicians (Cooper, Kim, and Urpelainen 2018). Here we compare fracking and non-fracking counties in terms of the Democratic share of the two-party vote in presidential elections. Before fracking, fracking counties were about two percentage points less Democratic, but after fracking this difference becomes closer to eight points; the difference in differences is -5.94, with a standard error of 0.50. Second, we examine a measure of competition, the absolute value of Democratic vote share minus 50.[8] We find that fracking areas become less competitive relative to non-fracking areas (the difference in differences is 3.83, with a standard error of 0.39).

Next, we examine three economic variables, starting with median income (measured in thou-

[8] Based on this measure, smaller numbers mean more competitive races and larger numbers mean less competitive races.

(a) All States

	Before Fracking			After Fracking			DiD
	No Fracking	Fracking	Diff.	No Fracking	Fracking	Diff.	
Turnout	53.95	50.34	-3.61***	56.80	49.78	-7.02***	-3.41***
			(0.52)			(0.59)	(0.35)
Dem. Pct.	41.39	39.41	-1.97**	40.03	32.12	-7.92***	-5.94***
			(0.71)			(0.82)	(0.50)
|Dem. Pct.-50|	12.06	13.45	1.39**	14.95	20.16	5.21***	3.83***
			(0.53)			(0.60)	(0.39)
Income	35.79	30.96	-4.83***	32.78	31.11	-1.67***	3.16***
			(0.39)			(0.42)	(0.28)
Gini	43.24	45.15	1.91***	43.40	44.66	1.26***	-0.65***
			(0.19)			(0.19)	(0.17)
Unemployment	5.64	6.71	1.07***	8.72	7.81	-0.92***	-1.99***
			(0.16)			(0.20)	(0.18)
College Pct.	16.76	14.32	-2.44***	20.42	17.00	-3.42***	-0.98***
			(0.34)			(0.39)	(0.14)
Migration	95.17	88.91	-6.26***	99.34	99.44	0.10	6.35***
			(1.03)			(1.00)	(1.40)
Drug Deaths	5.57	6.64	1.08***	12.94	14.64	1.70***	0.62**
			(0.26)			(0.39)	(0.20)

(b) High-Fracking States

	Before Fracking			After Fracking			DiD
	No Fracking	Fracking	Diff.	No Fracking	Fracking	Diff.	
Turnout	50.58	49.82	-0.76	51.10	48.31	-2.78***	-2.03***
			(0.70)			(0.80)	(0.45)
Dem. Pct.	39.31	38.15	-1.16	33.96	30.24	-3.72***	-2.56***
			(0.99)			(1.10)	(0.64)
|Dem. Pct.-50|	13.60	14.33	0.74	18.89	21.74	2.86***	2.12***
			(0.74)			(0.80)	(0.54)
Income	32.08	31.01	-1.07*	31.24	31.95	0.71	1.78***
			(0.53)			(0.58)	(0.36)
Gini	45.25	45.11	-0.14	44.49	44.71	0.22	0.36
			(0.26)			(0.27)	(0.26)
Unemployment	6.11	6.36	0.24	7.62	6.99	-0.64**	-0.88***
			(0.21)			(0.24)	(0.23)
College Pct.	14.98	14.47	-0.51	18.17	17.12	-1.05*	-0.54**
			(0.46)			(0.53)	(0.20)
Migration	90.18	88.54	-1.63	100.38	101.14	0.76	2.54
			(1.55)			(1.53)	(2.07)
Drug Deaths	5.42	5.78	0.37	12.62	13.41	0.79	0.43
			(0.29)			(0.49)	(0.28)

Table 3: Robust standard errors in parentheses. p<0.05, ** p<0.01, *** p<0.001.

sands of dollars). Even before fracking, fracking counties had median incomes that were almost $5,000 lower than non-fracking counties. The effects of the Great Recession were markedly smaller in fracking areas, however; income actually grew in fracking counties while it shrank in non-fracking counties, so that while fracking counties remained less wealthy after fracking than non-fracking counties, the gap had reduced. The difference in differences estimate in the last column indicates the economic effect of fracking on median income is 3.16 thousands (standard error of 0.28).

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 non-fracking areas. The difference in differences here is -0.65 (on a one hundred point scale), with a standard error of 0.17. Also relevant for fracking's economic impact, we find large reductions in unemployment due to fracking (estimate of -1.99, standard error of 0.18).

Last, we examine effects on measures of "social capital": education, migration, and deaths from drugs. Fracking areas had lower rates of college attainment prior to fracking; while college attainment increased everywhere over this period, the increase was smaller in fracking areas. Thus, the difference in differences suggests fracking caused a one 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 6.35 points (standard error of 1.4). And we find an increase in drug deaths per 100,000 county residents (estimate of 0.62, standard error of 0.2).

The bottom panel of Table 3 replicates the analysis for the seven high-fracking states. Corroborating the results presented in the previous sections, restricting the sample in this way substantially limits pre-fracking differences; only the pre-fracking difference for median income remains statistically significant in this subsample. The pattern of results in the final column, representing the differences in differences, are generally similar to the full sample results. Fracking decreases county-level turnout by 2.03 points (standard error of 0.45 points), decreases Democratic vote share by 2.56 (standard error of 0.64), and decreases political competition by 2.12 (standard error of 0.54). The income effect is smaller compared to the full sample, but still precisely estimated, at about $1,800 (standard error of about $400). 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 difference in differences estimates are the same as in the full sample, though they are smaller in magnitude and less precise.

Combined, the results presented in this section suggest that when income increases but educational attainment does not (or moves in the opposite direction), and individuals can afford to buy more drugs, there may be some negative consequences on turnout.

7 Partisan Consequences of Local Economic Shocks

Past studies show the types of politicians who the shale-affected areas elect, and the way they vote once in office, change after the boom. Cooper, Kim, and Urpelainen (2018) show the voting records of federal House members from fracking areas became more anti-environmental after shale energy booms. Fedaseyeu, Gilje, and Strahan (2018) also examine how fracking affects electoral competition at various levels, as well as roll call votes by members of Congress. They find that Republican candidates in presidential, congressional, and state gubernatorial races gain substantial support after fracking booms, and that the voting records of federal representatives become more conservative on all issue dimensions. They interpret this as a result of changes in voter preferences due to fracking, because many residents in fracking areas experience sharp increases in income and wealth. They also suggest that "our results emphasize the importance of interest groups as a key driver of political outcomes... we find large increases in the strength of conservative and business interests after the shale boom," although they are unable to show direct evidence for this claim.

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, we need to examine political participation at a more micro level. While these debates continue, it is important to examine how reported changes induced by fracking influenced political participation of individuals in the affected areas.

To investigate the partisan effects of fracking on turnout, we use the Catalist data on individual's ideology. The Catalist model predicts the propensity of an individual to hold progressive beliefs on a wide variety of issues based on their voting records and demographic information. Its score ranges from 0 to 100. 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 progressiveness of an individual compared to individuals who live in the same state. We divide individuals into five quintiles from the most conservative (1st quintile) to the most liberal (5th quintile). We then create interaction terms between a fracking variable at the zip code-level and each quintile.

Table 4 presents the results. Columns (1) through (3) presents the results when we include all states. Each column uses different a operationalization of fracking variables. The baseline includes the 1st quintile voters, who are the most conservative in their state. We observe turnout decreases for these voters. Interestingly, we observe that there are additional turnout declines for more liberal voters. For example, when we use a fracking dummy (Any Wells), turnout for voters in the 5th quintile declines by 2.76 percentage point more than the baseline voters (column (3)). Columns (4) through (6) present the results when we focus on seven high fracking states. We do not observe a turnout decline for the most conservative voters, but the turnout declinse become clear for other voters, with the magnitude of the effect becoming larger as voters become more liberal.

We also examine whether increased campaign contributions from fracking areas after shale gas booms have asymmetric partisan implications. To do so, we determine the percentage of total contributions given to Democratic candidates in each zip code area. Table 5 presents the

	All States			High-Fracking States		
	(1) Wells	(2) Log Wells	(3) Any Wells	(4) Wells	(5) Log Wells	(6) Any Wells
Baseline	-0.02***	-1.68***	-4.12***	-0.00	0.29	0.95
	(0.00)	(0.24)	(0.56)	(0.00)	(0.26)	(0.67)
X 2nd quintile	-0.00	-0.26	-0.48	-0.01	-1.02***	-2.63***
	(0.00)	(0.14)	(0.37)	(0.00)	(0.18)	(0.50)
X 3rd quintile	-0.00	-0.44**	-0.56	-0.01***	-1.48***	-3.14***
	(0.00)	(0.16)	(0.45)	(0.00)	(0.19)	(0.56)
X 4th quintile	-0.00	-0.65***	-0.97*	-0.01**	-1.88***	-4.33***
	(0.00)	(0.18)	(0.48)	(0.00)	(0.21)	(0.58)
X 5th quintile	-0.01	-1.19***	-2.76***	-0.02***	-2.44***	-6.95***
	(0.01)	(0.25)	(0.60)	(0.01)	(0.30)	(0.69)

Table 4: Fracking dummy is interacted with Catalist's ideology scale. * $p<0.05$, ** $p<0.01$, *** $p<0.001$. Baseline is the most conservative voters (1st quintile) and 5th quintile indicates the most liberal voters.

results. Regardless of the specifications and the set of states included in the analysis, campaign contributions given to Democrats in fracking areas declined, despite the fact that total campaign contributions from fracking areas significantly increased after shale booms. Dynamic analysis shows that the magnitude of Democratic disadvantage grew over time.

Table 6 presents another asymmetric effect of fracking on contributions by party. We examine how fracking is correlated with the total number of donors, the number of donors who contributed to Democrats, and the number of donors who contributed to Republicans in a given zip code. Column (1) shows that after fracking happened, the total number of donors from fracking areas declined in a given zip code. However, if we divide the total number of donors into those who gave to Democratic candidates (column (2)) and those who gave to Republican candidates (column (3)), there is the opposite pattern: the number of Democratic donors declined, whereas the number of donors supporting Republican candidates increased.

Table 7 presents the individual donor-level changes. We construct the campaign contribution data at the individual donor-level and examine whether individuals who live in fracking areas change their contribution behaviors. For each individual, we calculate the ratio of total contributions given to all Democratic candidates in any race, in federal-level races, and in state-level

	All States				High-Fracking States			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wells	-0.04***				-0.02*			
	(0.01)				(0.01)			
Log wells		-3.17***				-1.31***		
		(0.31)				(0.36)		
Any wells			-6.72***				-3.16**	
			(0.80)				(0.97)	
Frack X 2002				-0.02				-0.30
				(1.01)				(1.38)
Frack X 2004				-0.17				0.85
				(0.98)				(1.31)
Frack X 2006				-3.47***				-2.78*
				(1.02)				(1.38)
Frack X 2008				-5.88***				-4.35**
				(1.02)				(1.38)
Frack X 2010				-6.07***				-5.44***
				(1.03)				(1.40)
Frack X 2012				-9.88***				-6.05***
				(1.07)				(1.45)
Frack X 2014				-13.16***				-8.40***
				(1.20)				(1.60)

Table 5: Dem/(Dem+Rep)*100 contributions is the outcome * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

	(1) Total Donors	(2) Democratic Donors	(3) Republican Donors
Any Wells	-1.58*	-4.04***	1.82***
	(0.80)	(0.48)	(0.43)
Observations	178,080	178,080	178,080
Zipcode	29,680	29,680	29,680

Table 6: The effect of fracking booms on changes of the number of donors at the zip code level. Cell entries are regression coefficients with standard errors in parentheses. Standard errors are clustered by zip code. All specifications include year and zip code fixed effects. * p<0.05, ** p<0.01, *** p<0.001.

races. Columns (1) through (3) present the results when we use a binary measure for fracking and columns (4) through (6) present the results when we use (ln) number of wells as measures for fracking. Regardless of the measure of fracking we use, we find a consistent result: individuals who live in fracking areas reduced their contributions to Democratic candidates at all levels of elections after the fracking boom started. This suggests that resource booms changed the preferences of those individuals. In particular, those who donated to Democratic candidates before the fracking boom sharply reduced their contributions to Democrats after the fracking boom.

	(1) All	(2) Federal	(3) State	(4) All	(5) Federal	(6) State
Any Wells	-2.92***	-1.70**	-2.93***			
	(0.42)	(0.55)	(0.67)			
(ln) Wells				-1.44***	-1.03***	-1.37***
				(0.17)	(0.23)	(0.29)
Observations	8,086,643	4,297,495	4,304,604	8,086,643	4,297,495	4,304,604

Table 7: The effect of fracking booms on the percentage of contributions to Democratic candidates at the individual-zip code level. Dem/(Dem+Rep)*100 contributions is the outcome. Unit of observation is individual $\times$ zip code *times* election cycle. Cell entries are regression coefficients with standard errors in parentheses. Standard errors are clustered by individual-zip code. All specifications include total contributions, year and individual contributor fixed effects. * p<0.05, ** p<0.01, *** p<0.001.

In sum, the larger decline in turnout by more liberal voters and the disadvantages that Democratic candidates suffered in fundraising after fracking booms provide a micro-explanation of the

Republican Party's electoral success and increased anti-environmental voting records of elected politicians from fracking areas.

8 Conclusion

Income has been shown to have one of the strongest correlations with many forms of political participation, such as voter turnout and campaign contributions. Local economic shocks such as resource booms or import competition with China could significantly change individuals' income in the affected communities. When positive local economic shocks increase material fortunes of individuals, do they change their political participation? Do individuals in the affected community respond to uniformly to positive income shocks? Or are there heterogeneous effects of income shocks on political participation?

Using detailed data on horizontal gas wells at the zip code-level, this paper provides systematic analysis of the effect of positive local income shocks on different types of political participation at the individual level. Our analysis also reveals that, despite a substantial increase in income and wealth in fracking areas, fracking appears to have had a negative impact on voter turnout. We document that declining educational attainment and increasing use of drugs also occur in fracking areas, and these factors, combined with decrease in electoral competition, may be responsible for lowering turnout. We also find that fracking increases all measures of contributions, except contributions to Democrats. Individuals who previously contributed to Democratic candidates sharply reduced their contributions to Democrats after a fracking boom.

Resource-based income shocks also have important partisan consequences. Turnout declined more for liberal voters in fracking areas and increased campaign contributions from fracking areas only benefited Republican candidates. Given the environment is one of the most partisan issues 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 environmental issues. 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 partisan implications of income shocks on actual policy outcomes in environmental and regulatory issues will be a fruitful future research topic.

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