

Voter Rationality and Exogenous Shocks:

Misattribution of Responsibility for Economic Shocks

ABSTRACT

Elections serve as a democratic mechanism to hold leaders accountable for their actions. Voters are expected to reward or punish incumbent politicians for policies implemented during their previous term. Yet, recent research in political science suggests that voters are not rational in their decision making process and punish or reward incumbents for exogenous shocks. This study examines the effect of exogenous economic shocks on incumbency advantage in congressional elections. Specifically, it uses the production of fracking in congressional districts as an exogenous driver of increases in government and private revenue to assess how voters respond to exogenous shocks. Results show no significant effect of fracking on incumbent vote shares, suggesting voters are more rational than has been suggested in recent literature. Yet, Republican incumbents' vote share increases and Democrat incumbents' vote share decreases in fracking districts. This suggests that voters reward Republican incumbents, who are perceived as more favorable to fracking, and punish Democrat incumbents. Ideology therefore appears as a strong factor in voters' political choices. Finally, this study presents the need for further research to better understand the context and circumstances that shape voter rationality.

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I. Introduction

Incumbents appear to have a significant advantage over challengers when running for reelection. Some of this advantage may be due to incumbents' higher quality; those who can win an election may be better at their jobs than those who have yet to win an election. Rational voters measure the past performance of their incumbent against the proposed policies of the challenger and arrive at a voting decision. The question is whether voters accurately assess the performance of the incumbent. Economic shocks, for example, that might have occurred during the term of the incumbent could have been outside of his control. Rational voters should be able to disentangle what was due to the incumbent's action and what was outside of their control.

Voters should reward incumbents solely for actions that are within their control and not for exogenous shocks. Are voters rational with regards to how they process exogenous shocks when making political choices? This study will assess previous research and literature on the subject and use empirical methods to measure voter rationality and voters' response to exogenous shocks.

This study will use the presence of fracking revenue in congressional districts to measure a possible source of incumbency advantage due to exogenous economic shocks. Fracking is a technique used to extract gas and oil from shale rock. Modern fracking began in the 1990s, and its use has grown exponentially in the United States in the last two decades. Fracking is an exogenous factor that creates an as-if randomly assigned increase in both private and public revenue. Voters may reward incumbents for these increases in revenue, even though the revenue increases were not due to incumbents' actions. Using an Ordinary Least Squares (OLS) regression model and a difference in difference design, the study will test whether districts that produce fracking revenue have larger increases in incumbency advantage than non-fracking districts. Incumbency advantage will be measured using the vote share of incumbents.

II. Literature Review:

Scholars' interest in incumbency advantage began in the late 1960s when research began to show increasing vote margins of congressmen (Ansolabere and Snyder, 2002). Extensive research has been conducted on attempting to explain the causes of this advantage, and debate

persists in the political science field about how to assess the magnitude of incumbency advantage in a non-biased manner.

Many scholars have focused on how exogenous shocks affect incumbency advantage. For example shark attacks, tornados and football wins are exogenous factors that affect incumbency advantage (Achen and Bartels, 2016; Healy and Malhotra, 2010, 2013; Cramer and Jackson, 2006). Voters punish incumbents for negative shocks and reward incumbents for positive shocks. Research also shows that how governments respond to exogenous shocks influences voters' behavior. For example, if the government makes an announcement following a tornado and introduces measures to manage the tornados' devastating effects, voters will reward the incumbent. On the contrary, if the government does not respond to the incident and does not comment on it, voters punish the incumbent. This shows a nuanced perspective on voter rationality. Although voters punish incumbents for events outside of their control, they are able to reward incumbents for positive responses to exogenous shocks. Yet, cases remain where voters make mistakes and understanding the circumstances of when this happens is fundamental (Healy and Malhotra, 2013).

Research has also focused on how economic shocks affect voters' political choices. Positive shocks greatly increase chances of reelection and negative shocks decrease chances of reelection (Novaes and Schiumerini, 2017). International economic factors, for example, are exogenous shocks that affect voters' decision to reward or punish the incumbent (Campello and Zucco, 2013). Also, when the economy is perceived as bad (whether this be true or not) voters punish their incumbent representative, who is less likely to win elections (Kinder and Kiewiet, 1981). Finally, voters are more likely to attribute economic responsibility to their representative if it is easier to assign responsibility. For example, in places with less foreign trade, representatives are held more accountable for any economic outcome. In this sense, voters seem to be responding to government performance but only in certain contexts. Further research needs to be conducted on whether voters *correctly* respond to exogenous shocks when making political choices. Yet, while economic conditions are important criteria in a voter's decision process, voters only take into account the economic conditions for the three months prior to an election (Achen and Bartels, 2016).

Building on existing literature suggesting voters are irrational in how they respond to exogenous shocks, this study will use the presence of fracking to test whether voters misattribute

exogenous shocks to the incumbent. While previous research tends to simply assess how voters punish or reward incumbents for exogenous shocks, this study will test if ideology affects voter response to exogenous shocks. Some voters might punish the incumbent and some voters might reward the incumbent for the same exogenous shock. In this sense, this study will evaluate how the type of shock is important to determine voter rationality, or lack thereof. Also, previous literature on incumbency advantage typically used probability of reelection as a measure of incumbency advantage. Instead of using probability of reelection, this study will use the margin of victory to study incumbency advantage. Since incumbents often win reelection, looking at whether incumbents win or lose their reelection races would not measure the full scope of incumbency advantage. Instead, this study will test whether vote shares increase for incumbents following a shale boom.

III. Theory

Fracking is an exogenous factor that creates an as-if randomly assigned increase in both private and public revenue. It brings in new economic resources that shape voters' political choices. Previous literature suggests economic shocks create a unanimous response from voters, meaning all voters punish or reward the incumbent. Ideology about fracking is divided between Republicans, who tend to be more pro-fracking, and Democrats, who tend to be more pro-environment. This study incorporates a party effect that will allow me to test whether voters' response to exogenous economic shocks is shaped by ideology.

This study uses a two-part theory to assess the full scope of exogenous shocks' impact on incumbency advantage. The first part of the theory will assess how fracking affects incumbents' votes share overall. This will allow me to evaluate how voters respond to exogenous shocks, by testing whether they misattribute responsibility for the shock to their representative. The second part of the theory will analyze how voters take ideology and political beliefs into account when making political choices. Since Republicans are more favorable to fracking than Democrats, the second part of the study will assess the differential effect of fracking on incumbency advantage for Democrats versus Republicans.

Fracking as an Exogenous Shock

Fracking is a process using a high pressure mix of water, sand and chemicals to recover gas and oil from shale rock. The process is usually carried out by drilling down horizontally to release gas. Fracking has revolutionized the United States energy sector but has also come with vast environmental implications. Many scholars have written about the environmental implications of fracking and how fracking should be regulated to contain the negative environmental repercussions. Some scholars argue that fracking should be regulated at the federal level since it has repercussions on the overall U.S economy and environmental policy, while others argue that fracking regulations should be decided at the state level. Since this debate persists in the academic sphere and in politics, a grey area remains as to how fracking is regulated. As of now, fracking is mostly regulated at the state level, with some environmental ‘conditions’, such as full disclosure of chemicals imposed at the federal level. To date, fracking is banned in Maryland, New York and Vermont. Fracking is legal in most states, but states and counties vary on what restrictions and regulations they impose on fracking. For example, in California, fracking is legal but particular tests need to be conducted to determine if contamination of water has occurred due to fracking. Similarly, Pennsylvania imposed a law that requires full disclosure of the chemicals released in the fracking process. Although these laws vary by state, fracking is legal in most parts of the United States and regulations remain weak. States have a certain level of control in deciding whether to produce fracking and while three states have imposed complete bans on fracking, all other states only vary in the measures, requirements and disclosure they demand of fracking producers. We can therefore assume that fracking is an exogenous – although imperfect – measure of how voters respond to exogenous shocks.

a. Effect of Fracking on Incumbency advantage

Previous research on voter rationality suggests that voters reward and punish incumbents for events outside of their control. Economic shocks are an important factor in voters’ political decision process. The causal model of this study is that exogenous factors– unrelated to incumbent quality – also affect incumbency advantage. The production of fracking creates a shale boom that has positive repercussions on the economy with an increase in both government

and private revenue. Shale booms might also increase employment rates and wages (Weber, 2012; Allcott and Keniston, 2014). All these repercussions are unrelated to the work of the incumbent, yet may have a positive effect on incumbency advantage. Voters may misattribute and reward incumbents for shale booms that are outside of their control. Since research began on incumbency advantage, scholars have found a pattern of exogenous shocks affecting political accountability. Achen and Bartels (2016) show that voters are not necessarily rational actors that take into account the work of their political representatives when casting votes, but rather rely on exogenous factors to assess an incumbent's quality. Voters are expected to misattribute the positive economic shock from the production of fracking to their representative. Incumbency advantage would therefore increase following a shale boom.

This leads me to the following hypothesis:

H1: Incumbents' vote share increases in districts that produce fracking.

b. Effect of fracking on incumbency advantage by party

In the United States, research shows that support for conservatives rises after fracking begins and that Republican candidates gain more votes. One reason for this is that Republicans are more likely to support pro-fracking policies. Shale development stimulates local job creation and economic activity (Fedaseyeu et al., 2017). This would explain why citizens who gain from shale booms are more likely to elect Republicans, who are usually more pro-fracking than Democrat candidates. The number of self-reported Democrats who shift parties to vote for the Republican candidate increases following the beginning of fracking. This means that voters reelect the Republican incumbent in a fracking district with a higher increase in margin of victory *relative* to the Democrat incumbent.

The reality is that Republicans are indeed more pro-fracking than Democrats but might vote against pro-fracking (or for pro-environment policies) if the bill is framed in a certain manner. Kalaf-Hughes and Kear (2017) show that Republicans are more likely to vote against anti-fracking legislation as the number of environmental frames increases relative to the number of economic frames. Democrats consistently vote against fracking, regardless of the framing ratio of economic relative to environmental framing in the legislation. Voters are expected to

reward Republican incumbents relatively more than Democrats because Republicans are more likely to enact future pro-fracking legislation. Further, voters might also believe that a pro-fracking incumbent was responsible for the shale boom. In this sense, it is easier for voters to misattribute responsibility for fracking to a Republican incumbent. Voters might therefore reward Republicans by a higher increase in margin of victory than Democrats. The party divide regarding fracking allows me to measure how ideology influences voter response to exogenous economic shocks.

This leads me to the following hypothesis:

H2: In fracking districts, Republican incumbents' vote share increases by a higher percentage *relative* to Democrat incumbents' vote share.

The random allocation of fracking will be used as a tool to assess how voters respond to exogenous shocks. More specifically, this study will shed light on how exogenous shocks factor in the political decision process of voters and ultimately suggest a conclusion as to whether voters are rational when making political choices. Further, the study will test how ideology and the type of shock affect voters' response. Findings of previous research on exogenous shocks might have depended on the nature of the shock scholars' studied. Fracking, specifically the ideological component of fracking, allows me to measure how the same shock can create different responses from voters who factor ideology into their decision.

IV. Data and Methods

The final dataset for this study consists of congressional election results at the district level from 1996 to 2012. The unit of analysis is the election year at the district level. The dependent variable is the vote share of incumbents. The study will test whether incumbents in districts that produce fracking experience an increase in their margin of victory after fracking begins in a district. The independent variable is fracking. The model codes a district as a fracking-district if any county in that district is producing fracking. This allows me to test whether any fracking (even a small amount) has an effect on incumbency advantage. Since

congressional elections take place every other year, the model will consider whether there was fracking during an ‘election cycle,’ meaning if there was any fracking in that district in the two years prior to an election. Each election in a given district can then be coded as a fracking election if there was any fracking in the two years leading up to that election. Controls include how many terms an incumbent has been in office and average annual income in that district. Using year and district fixed effects will also control for shocks in various years.

a. Fracking

The fracking data includes data from 1996 to 2012 at the county level and shows whether a county has been producing fracking revenue in a given year. *ArcGIS* was used to map counties into districts so that all datasets have a common unit of analysis. Each county is identified as belonging to a congressional district so that the data has a common unit of analysis. The unit of analysis is State, district, and election year. It is important to note that *ArcGIS* mapped counties into districts using the center of the county, meaning that if the center of a county was in a district, the county was coded as belonging to that district. This generates a few errors, especially along the coast, where the geometric center of the district might be in the ocean, for example. There is therefore a minimal amount of counties that were dropped from the study, as they were not included in a district. Any county bordering two districts might also be coded as being in the wrong district if the center of the county was located in the bordering district. Once again, this amounts to a very small percentage of counties.¹ Professor You, from the Politics Department at New York University, provided the fracking data for this study. There are 52,752 observations in this dataset and 16.21% of counties included in the dataset produce fracking for all years combined.

b. Congressional election results

For congressional elections, the data is from 1968 to 2012 and includes all districts (or equivalent – such as Washington D.C which is a federal district) in the United States. The dataset

¹ It is also important to note that no data is available on areas that have shale rock but do not exploit it. If such data existed, one would be able to compare, among areas that possess shale rock, those that exploit it and those that do not exploit it. As such data is not currently available, the study will use the random allocation of fracking and literature suggesting shale rock is mostly exploited if found, to measure voters’ response to exogenous shocks. Although states have a relative amount of control over production of fracking, the fact that possession of shale rock is random and that most places allow fracking makes it an exogenous driver of incumbency advantage.

also includes incumbent status, party, and vote share. The elections dataset was downloaded from the “Voting and Elections Collection” website. *CQ Press*, a division of SAGE publications that publishes products on American government and politics, published this collection. The dataset includes all congressional districts in the United States and presents the vote share obtained by all candidates running for election from 1968 to 2012. There are 9,902 observations in this dataset. The dataset also includes the incumbent status, meaning whether the candidate is the incumbent or the challenger.

Measure of incumbency advantage:

Incumbency advantage will be measured by looking at the margin of victory of incumbent candidates in congressional elections. Since incumbents very often win reelection, it is not sufficient to simply observe whether the incumbent is reelected using a dummy variable. Instead, assuming incumbency advantage increases following a shale boom, we can expect that the margin of victory for the same incumbent will be higher in an election post-shale boom as compared to an election pre-shale boom. Since incumbents often win reelection, the model will only take into account races with incumbents and observe trends in the margins of victory of incumbents.

a. Controls: annual average wage and terms in office

The study will use the average annual wage by district to control for endogenous economic factors that might affect the effect of fracking on incumbency advantage. Controlling for annual average income ensures that any economic policies that might affect individual’s income are taken into account in the regression model. Income data was obtained from the *Bureau of Labor Statistics* for the time frame 1996-2012.

The study will also control for the number of terms an incumbent has been in office. Since incumbency advantage increases over time, controlling for the number of terms an incumbent has been in office for each election year will eliminate bias that might interfere with the model.

b. Descriptive Statistics

Variable	Descriptive Statistics				
	Observations	Mean	Standard Deviation	Min	Max
Incumbent Vote Share	8,470	70.393	15.326	0	100
Democrat Incumbent Vote Share	4,744	72.230	15.967	0	100
Republican Incumbent Vote Share	3,747	67.957	14.168	0	100
Fracking	3,182	0.276	0.447	0	1
Annual Average Pay	3,097	39533.37	10526.82	13,411	103,243
Incumbent Terms	8,470	3.736	2.902	1	20
Republican Incumbent Terms	3,747	3.548	2.798	1	20
Democrat Incumbent Terms	4,744	3.877	2.973	1	19

V. Empirical Methods

Two different models will be used to determine the effect of fracking on incumbency advantage: an OLS regression with fixed effects and a difference in difference design.

a. OLS regression with fixed effects

An initial OLS regression will be used to assess the effect of fracking on incumbency advantage. Since one of the hypotheses is that incumbency advantage increases by a higher percentage in districts with Republican incumbents relative to districts with Democrat incumbents, three different regressions will be conducted to assess the increase in incumbency advantage overall and for Republican and Democrat incumbents.

The OLS procedure will be conducted as follows:

$$\text{Incumbent Vote Share}_{dt} = \alpha + \beta_1(\text{Fracking}) + \beta_2(\text{Income}) + \beta_3(\text{Terms}) + \alpha_d + t_t + e_{dt} \quad (1)$$

$$\text{Republican Incumbent Vote Share}_{dt} = \alpha + \beta_1(\text{Fracking}) + \beta_2(\text{Income}) + \beta_3(\text{Terms}) + \alpha_d + t_t + e_{dt} \quad (2)$$

$$\text{Democrat Incumbent Vote Share}_{dt} = \alpha + \beta_1(\text{Fracking}) + \beta_2(\text{Income}) + \beta_3(\text{Terms}) + \alpha_d + t_t + e_{dt} \quad (3)$$

The main component of interest in this equation is (*Fracking*), as the OLS regression will measure the effect of fracking on incumbent vote share (and in the second and third equations for Republican and Democrat incumbents, respectively). The dependent variable is the vote share of the incumbent (and specifically for Democrat and Republican incumbents in the two following equations). The independent variable is the dummy variable (*Fracking*), which takes a value of 1

if any county in a district is producing fracking. Finally, control variables include (*Income*) which is the annual average income in each district for each year, and (*Terms*) which is the number of terms the incumbent has served for each election year and in each district. Year and district fixed effects have been included in the equation.

In order to provide empirical evidence for each hypothesis, three separate regressions will be conducted to assess how exogenous shocks independently affect the vote share of incumbents overall and that of Republican and Democrat incumbents. Even with controls and fixed effects, unobserved differences remain across districts, years and representatives. Production of fracking might also represent, to a certain extent, the decision of representatives. This study therefore uses robust standard errors, clustered by district, in all models.

Since an OLS regression does not sufficiently account for differences across districts and differences throughout time, a difference in difference method will be used to further determine the effect of fracking on incumbent's vote share. In the same manner as for the OLS regression, the difference in difference model will be conducted for incumbents overall, and specifically for Democrat and Republican incumbents.

b. Difference in Difference

The difference in difference model uses the 2007 technology shock in fracking as a treatment variable. In 2007, a consortium of international private equity firms invested heavily into what is now Energy Future Holdings. By 2007, new fracking methods made it viable to profit from exploiting shale rock. A Canadian energy company also started using a new technique called LPG gel to stimulate shale rock. Since then, energy companies have started using this technique to extract more shale rock, both in Canada and the United States. 2007 was the year fracking became a viable and very profitable business. Many US energy companies began to realize that the United States contains vast supplies of shale rock. They began to extract natural gas that they could obtain through revolutionary fracking technology that did not exist prior to 2007. 2007 is therefore a year of technological and price shock for fracking and will serve as the treatment year for the difference in difference model.

Decker and McCollum (2017) explain that by 2007, after a sharp decline in production in the previous year, a technological breakthrough allowed fracking to become economically viable for the first time. This is what marked the beginning of the 'shale boom.' They also report that

every county that the U.S. Energy Information Administration (EIA) defines to have shale rock activity increased their fracking production in 2007 and that fracking levels remained high until 2014. The year 2007 as a technology revolution in fracking remains open to debate but is consistent with the EIA's research on the beginning of en masse fracking in 2007. The study will therefore use the variable *Boom* as a treatment in the difference in difference model.

The difference in difference procedure will be conducted as follows:

$$\text{Incumbent Vote Share}_{dt} = \alpha + \beta_1(\text{Fracking}) + \beta_2(\text{Boom}) + \beta_3(\text{Fracking*Boom}) + \beta_4(\text{Income}) + \beta_5(\text{Terms}) + e_{dt} \quad (1)$$

$$\text{Republican Incumbent Vote Share}_{dt} = \alpha + \beta_1(\text{Fracking}) + \beta_2(\text{Boom}) + \beta_3(\text{Fracking*Boom}) + \beta_4(\text{Income}) + \beta_5(\text{Terms}) + e_{dt} \quad (2)$$

$$\text{Democrat Incumbent Vote Share}_{dt} = \alpha + \beta_1(\text{Fracking}) + \beta_2(\text{Boom}) + \beta_3(\text{Fracking*Boom}) + \beta_4(\text{Income}) + \beta_5(\text{Terms}) + e_{dt} \quad (3)$$

The dependent variable is the vote share of the incumbent. As for the OLS regression, three equations are included in the difference in difference model to individually analyze the effect of fracking on incumbents overall, Democrat incumbents and Republican incumbents.

In this equation, (*Fracking*) represents whether the district is producing fracking in a given year. Fracking districts are part of the treatment group and non-fracking districts are part of the control group. (*Boom*) is the treatment year 2007 when the masse drilling began across the United States, the variable (*Fracking*Boom*) presents the interaction between the two variables. Control variables remain the same as in the OLS regression and include (*Income*) and (*Terms*), meaning the model controls for the number of terms an incumbent has been in office and mean income by district and year. As in the OLS model, unobserved differences might remain across districts, years and representatives. This study therefore uses robust standard errors, clustered by district, in all models.

a. Need for controls, fixed effects and cluster

Other factors than fracking might increase incumbency advantage in fracking districts. There might be another positive or negative economic shock, unrelated to fracking, that impacts voters' behavior in a given election year. This study will use annual average income per person

in each district to control for changing economic circumstances that might affect voters. Although the production of fracking might be affecting some voters' wages, controlling for income ensures that an increase in incumbency advantage is not due to economic factors unrelated to fracking that might have increased income.

The study will also control for the number of terms an incumbent has been in office. Previous literature suggests that incumbency advantage increases the longer the incumbent has been in office. Controlling for the number of terms an incumbent has been in office for each election year removes unwanted bias. Finally, the study will use district and year fixed effects to control for potential shocks in various districts and years. Clustering by district will also be used as the fracking data was originally at the county level. Using fracking to create a random natural experiment and to study how exogenous shocks affect incumbency advantage, the study will be able to assess if voters are rational in how they hold incumbents responsible for their actions.

VI. Results

a. OLS Regression

TABLE 2: Effect of fracking on incumbent vote share.

VARIABLES	(1) Incumbent Vote Share	(2) Democrat Incumbent Vote Share	(3) Republican Incumbent Vote Share
Fracking	0.574 (1.178)	-3.247** (1.266)	2.611* (1.498)
Income	6.51e-05 (7.31e-05)	0.000221** (9.85e-05)	-0.000194* (0.000108)
Terms (incumbents)	0.548*** (0.124)		
Terms (Democrats)		0.475*** (0.171)	
Terms (Republicans)			0.492*** (0.148)
Constant	56.12*** (2.885)	54.86*** (3.688)	74.43*** (5.273)
Observations	2,650	1,173	1,482
R-squared	0.084	0.215	0.159

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

NOTE: All predictors at their mean value

The coefficient in Table 2, column 1, does not have significant results, demonstrating that there is no statistically significant increase in overall incumbent vote share in districts that produce fracking as compared to incumbent vote share in districts that do not produce fracking. This would suggest that voters are rational in their distribution of responsibility to their representative. Although fracking produces an increase in private and public revenue, voters appear to take into account the exogeneity of this shock and do not attribute it to their representative.

However, the negative coefficient in Table 2, column 2, has significant effects at the 5% level, demonstrating that voters punish Democrat incumbents in fracking districts. Results show that the vote share of Democrat incumbents in fracking districts decreased by 3.25 percentage points. This suggests that partisanship plays an important role in how voters process a fracking

shock when making political choices. This builds on the causal mechanism that voters respond to exogenous shocks when making political decisions. A decrease in incumbency advantage for Democrats suggests that voters identify Democrats as more anti-fracking than Republicans. Following a positive economic shock due to fracking, voters decrease their support for Democrat candidates, who might oppose further fracking in the district. This also suggests that partisanship affects how voters misattribute responsibility. Voters misattribute responsibility to Republicans but not to Democrats. This would explain why they increase support for Republicans, who might support fracking in the future, and punish Democrats, who are perceived as anti-fracking. This is surprising considering fracking occurred during the Democrat's term, yet voters punish the Democrat incumbent for the positive shock associated with fracking.

The positive coefficient in Table 2, column 3, has significant effects at the 10% level, demonstrating that voters reward Republican incumbents following a shale boom. The positive coefficient indicates that voters increase their support for Republicans by 2.61 percentage points in fracking districts as compared to non-fracking districts. This shows that the second hypothesis discussed in this study – that incumbency advantage increases more for Republicans as compared to Democrats – holds in part as results suggest an increase in incumbency advantage for Republicans and a decrease in incumbency advantage for Democrats.

b. Difference in Difference

TABLE 3: Effect of fracking on incumbent vote share.

VARIABLES	(1) Incumbent Vote Share	(2) Democrat Incumbent Vote Share	(3) Republican Incumbent Vote Share
Boom	-3.586*** (0.742)	-7.353*** (1.216)	-0.00232 (0.874)
Fracking	48.92 (256.7)	946.1** (451.6)	-565.8*** (194.0)
Diff-in-Diff	-0.0241 (0.128)	-0.474** (0.225)	0.284*** (0.0967)
Income	4.76e-05 (5.77e-05)	0.000265*** (7.18e-05)	-0.000239*** (8.23e-05)
Terms (Incumbents)	0.540*** (0.119)		
Terms (Democrats)		0.464*** (0.165)	
Terms (Republicans)			0.616*** (0.141)
Constant	65.37*** (2.389)	59.48*** (3.072)	73.80*** (3.092)
Observations	2,650	1,173	1,482
R-squared	0.024	0.078	0.042

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

NOTE: All predictors at their mean value

The results obtained from the difference in difference model (Table 3) correspond – and therefore reinforce – the results obtained from the OLS regression model. As with the OLS Regression model, the lack of significant results for increase in overall incumbent vote share suggests that voters do not reward incumbents for exogenous shocks outside of their control. Voters are more rational than is suggested in previous literature and research on the subject. Despite the increase in public and private revenue generated by a shale boom, voters do not respond by increasing support for the incumbent candidate.

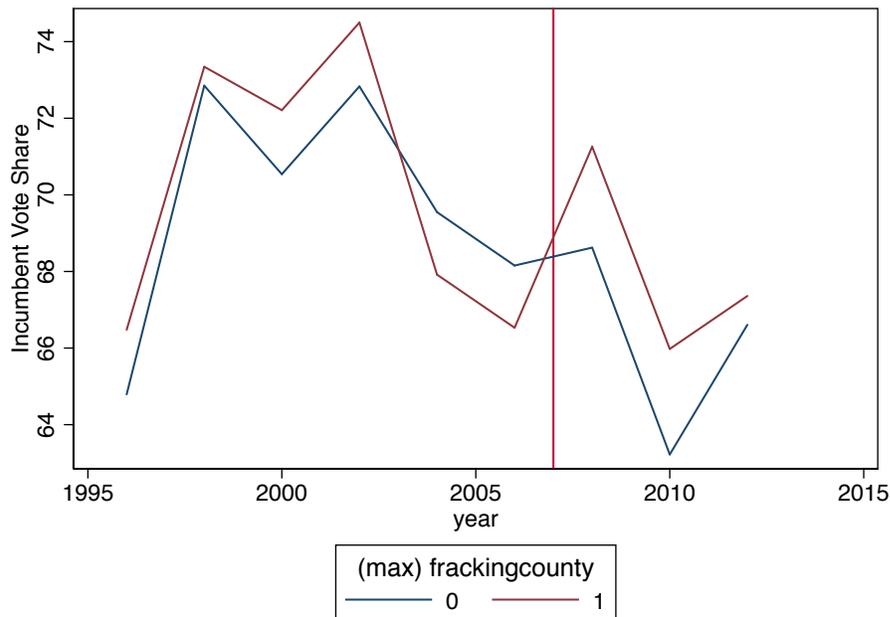
Results in Table 3, column 2, present significant effects of fracking on Democrat incumbent vote share at the 5% level. The negative coefficient of -0.47 suggests that Democrat incumbent vote share decreases by approximately half a percentage point in fracking districts.

Although this goes against the hypothesis that incumbency advantage increases following a shale boom, it is central to the theory in that incumbency advantage decreases for Democrats but increases for Republicans. This suggests that voters take ideology into account when making political choices.

Results in Table 3, column 3, present significant results at the 1% level of fracking on Republican incumbent vote share, demonstrating that voters are more likely to reelect Republican incumbents following a shale boom. The positive coefficient of 0.28 shows that Republican incumbent vote share increases by 0.28% in fracking districts as compared to non-fracking districts. This lends credence to the second hypothesis that Republican incumbents vote share increases by a higher percentage than that of Democrat incumbents. This builds on the causal mechanism that voters identify Republicans as more pro-fracking than Democrats and are therefore more likely to reelect Republican (as opposed to Democrat) incumbents following a shale boom.

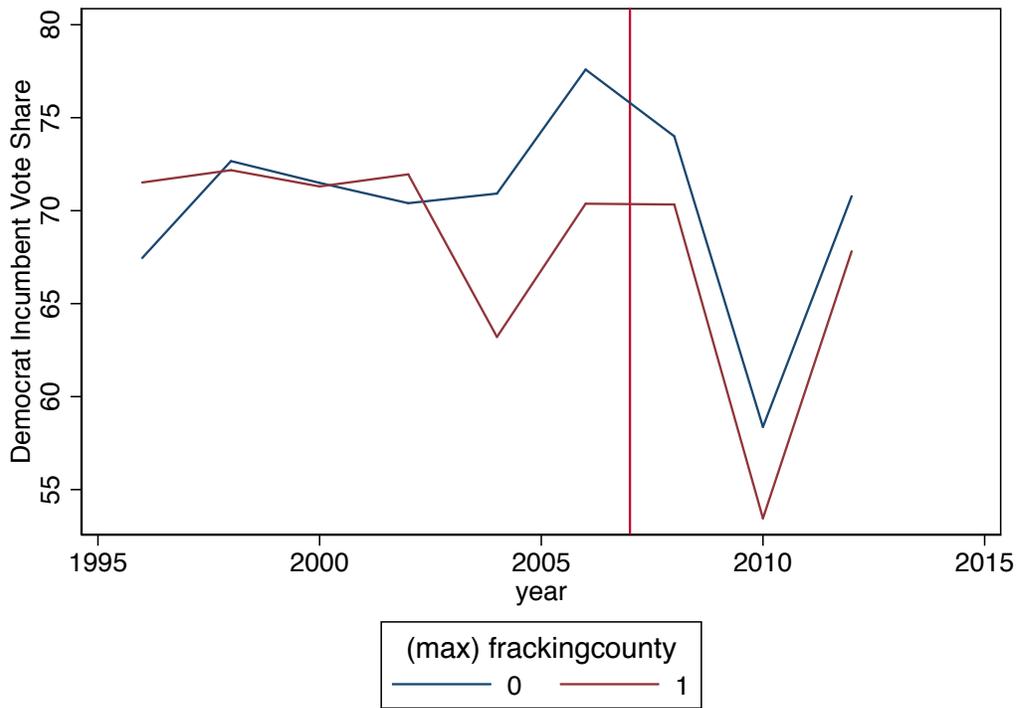
c. Parallel Trend Assumption:

A main component of the Difference in Difference model is the assumption of parallel trends. Graphs illustrating the trends in fracking and non-fracking districts pre and post-treatment will be used to assess if the parallel trend assumption holds in the difference in difference model.

GRAPH 1: Testing of parallel trend assumption for incumbent vote share:

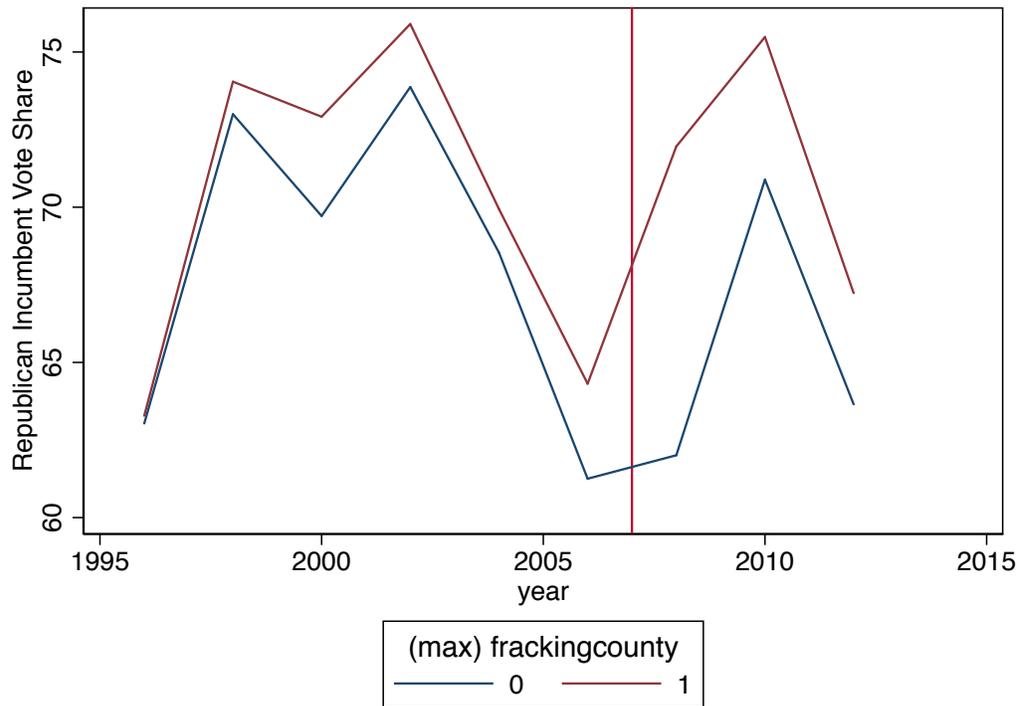
In Graph 1, the dependent variable is incumbent vote share and *frackingcounty* takes a value of 0 if there is no fracking in a district and 1 if there is any fracking in a district. This graph shows that the parallel trend assumption seems to hold for the effect of fracking on incumbent vote share overall. Results from the difference in difference model showed no significant results for the effect of fracking on incumbent vote share. The OLS regression model also showed no significant results for the effect of fracking on incumbency advantage overall. The fact that both the OLS regression and difference in difference models showed no significant effect of fracking on incumbency advantage overall contributes to the causal mechanism that fracking does not increase incumbency advantage.

GRAPH 2: Testing of parallel trend assumption for Democrat incumbent vote share:



In Graph 2, the dependent variable is the Democrat incumbent vote share and *frackingcounty* takes a value of 0 if there is no fracking in a district and 1 if there is any fracking in a district. This graph presents a strong defense of the parallel trend assumption from 2003 to 2012. Prior to 2003, the parallel trend assumption does not seem to hold. Fracking districts and non-fracking districts exhibit similar trends in their behavior from 2003 to 2012. It also seems that 2006 represents a breaking point in the data.

Graph 3: Testing of parallel trend assumption for Republican incumbent vote share:



In Graph 3, the dependent variable is the Republican incumbent vote share and *frackingcounty* takes a value of 0 if there is no fracking in a district and 1 if there is any fracking in a district. This graph shows that the parallel trend assumption holds for Republican incumbents vote share. Similarly to the trends for Democrat incumbents, it seems that 2006 represents a breaking point in the data.

For both Democrat and Republican incumbents, the parallel trend assumption seems to hold best from 2003 to 2010, and 2006 appears as a breaking point in the data. A second difference in difference model will therefore be used, with data from 2003 to 2010 and with 2006 as the treatment year. 2006 is less arguably the year the shale boom began in the United States. Yet, some scholars have argued that the effects of the US shale boom began in 2006. Brown and Yucel (2013) make a strong defense of 2006 as the year fossil fuel became important to states’ economic performance. Results appear as follows:

TABLE 4: Effect of fracking on incumbent vote share (treatment year 2006)

VARIABLES	(1) Incumbent Vote Share	(2) Democrat Incumbent Vote Share	(3) Republican Incumbent Vote Share
Boom	-3.109*** (1.118)	-0.583 (1.757)	-5.234*** (1.452)
Fracking	-478.6 (1,132)	3,983*** (1,256)	-4,485*** (1,151)
Diff-in-Diff	0.239 (0.564)	-1.987*** (0.626)	2.237*** (0.574)
Income	8.13e-05 (9.11e-05)	0.000232** (9.53e-05)	-0.000154 (0.000100)
Terms (Incumbent)	0.623*** (0.176)		
Terms (Democrat)		0.718*** (0.203)	
Terms (Republican)			0.442* (0.238)
Constant	63.16*** (4.069)	55.81*** (4.003)	73.39*** (4.649)
Observations	1,219	579	641
R-squared	0.027	0.089	0.076

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

NOTE: All predictors at their mean value

Table 4 presents significant results for the effect of fracking on Democrat and Republican incumbent vote share at the 1% level. There are no significant results of fracking on incumbent vote share overall. These results correspond to the results obtained from the OLS regression and difference in difference models. The one notable difference is that the results for Republicans and Democrats are significant at the 1% level, meaning a higher significance level than in the previous models.

The fact that the parallel trend assumption holds, and that results are significant for Democrats and Republicans in all three models, provides strong support to the causal mechanisms at the center of this theory. Voters' response to economic shocks is nuanced, as opposed to what is suggested in previous literature. They do not respond in one way, by punishing or rewarding the incumbent. Rather, they take ideology into account to punish the

Democrat and reward the Republican. One economic shock can therefore create two different responses from voters based on the party of the incumbent. Although the second part of the study differentiating between parties demonstrates that voters misattribute exogenous shocks to their representative, they still include political beliefs and ideology in their political decision process. Republicans are rewarded and Democrats are punished for the same exogenous shock.

VII. Conclusion and discussion

The findings of this study consistently suggest that fracking districts experiences an increase in incumbency advantage for Republicans and a decrease in incumbency advantage for Democrats. Voters respond to exogenous shocks by punishing or rewarding incumbents for events that are beyond their control. This research shows that voters are not fully rational actors and hold politicians accountable for shocks beyond their control.

This research design makes a strong causal inference about how fracking influences incumbency advantage in U.S. congressional elections. Previous research studying causes of incumbency advantage often did not disentangle factors that were exogenous to incumbent quality from those within the control of the incumbent. Also, existing empirical research does not fully assess the magnitude of exogenous shocks on incumbency advantage. Findings about causes of incumbency advantage were often endogenous to incumbent candidate quality.

This study finds that voters misattribute responsibility to their representative. Yet, contrarily to previous literature suggesting that voters are irrational to the point that elections amount to the same as tossing a coin (Achen and Bartels, 2016), empirical methods used in this study show voter rationality is more nuanced than is commonly thought. Voters misattribute responsibility but are still capable of varying the level of responsibility they assign to the incumbent based on partisanship. Republicans are perceived – and are in reality – more likely to support pro-fracking legislation than Democrats. The fact that voters are able to take this into account in their political decision process provides support to the theory that voters are in part rational in how they attribute responsibility.

Another aspect of exogenous shocks this research finds is that the same shock can create a differential response from voters. Whereas previous literature found shocks create one common response from voters, this study shows the same shock can create various responses. Voters take

ideology into account when responding to a fracking shock, and this creates a different response based on the party of the incumbent. Voters reward Republicans and punish Democrats for the same shock. This shows voter response to certain types of exogenous shocks cannot be assessed without taking ideological aspects into account.

Finally, this study presents the need for further research into voting behavior and democratic accountability. Findings suggest voters are rational to a certain extent, and do not blindly reelect the incumbent, regardless of their party or ideology, following a shale boom. Future research must be conducted to assess the degree of voter rationality and to better understand circumstances and context that affect voters' response to exogenous shocks.

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Appendix: Tables and Graphs

TABLE 1: Descriptive Statistics

Variable	Descriptive Statistics				
	Observations	Mean	Standard Deviation	Min	Max
Incumbent Vote Share	8,470	70.393	15.326	0	100
Democrat Incumbent Vote Share	4,744	72.230	15.967	0	100
Republican Incumbent Vote Share	3,747	67.957	14.168	0	100
Fracking	3,182	0.276	0.447	0	1
Annual Average Pay	3,097	39533.37	10526.82	13,411	103,243
Incumbent Terms	8,470	3.736	2.902	1	20
Republican Incumbent Terms	3,747	3.548	2.798	1	20
Democrat Incumbent Terms	4,744	3.877	2.973	1	19

TABLE 2: OLS regression results

VARIABLES	(1) Incumbent Vote Share	(2) Democrat Incumbent Vote Share	(3) Republican Incumbent Vote Share
Fracking	0.574 (1.178)	-3.247** (1.266)	2.611* (1.498)
Income	6.51e-05 (7.31e-05)	0.000221** (9.85e-05)	-0.000194* (0.000108)
Terms (Incumbent)	0.548*** (0.124)		
Terms (Democrats)		0.475*** (0.171)	
Terms (Republicans)			0.492*** (0.148)
Constant	56.12*** (2.885)	54.86*** (3.688)	74.43*** (5.273)
Observations	2,650	1,173	1,482
R-squared	0.084	0.215	0.159

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

NOTE: All predictors at their mean value

TABLE 3: Difference in Difference results (Treatment year 2007).

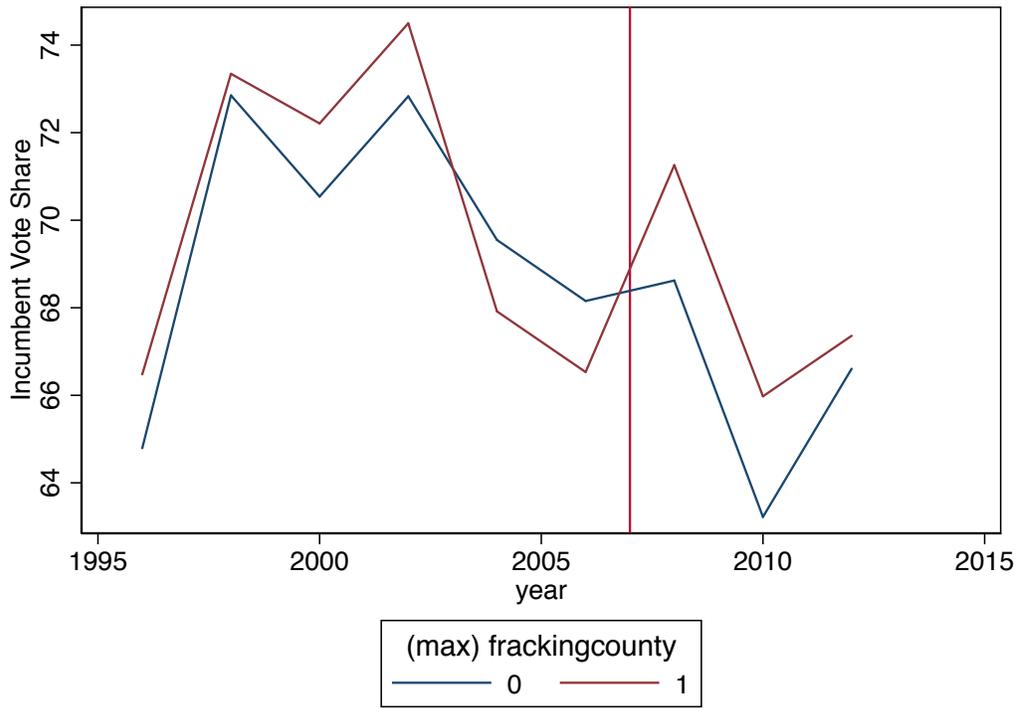
VARIABLES	(1) Incumbent Vote Share	(2) Democrat Incumbent Vote Share	(3) Republican Incumbent Vote Share
Boom	-3.586*** (0.742)	-7.353*** (1.216)	-0.00232 (0.874)
Fracking	48.92 (256.7)	946.1** (451.6)	-565.8*** (194.0)
Diff-in-Diff	-0.0241 (0.128)	-0.474** (0.225)	0.284*** (0.0967)
Income	4.76e-05 (5.77e-05)	0.000265*** (7.18e-05)	-0.000239*** (8.23e-05)
Terms (Incumbents)	0.540*** (0.119)		
Terms (Democrats)		0.464*** (0.165)	
Terms (Republicans)			0.616*** (0.141)
Constant	65.37*** (2.389)	59.48*** (3.072)	73.80*** (3.092)
Observations	2,650	1,173	1,482
R-squared	0.024	0.078	0.042

Robust standard errors in parentheses

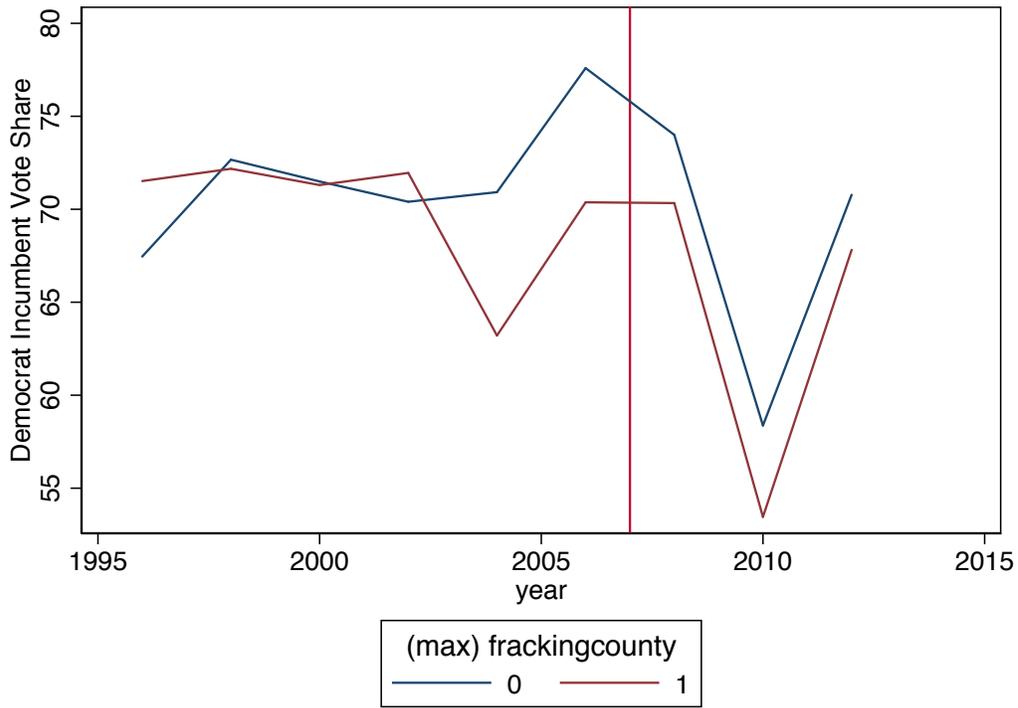
*** p<0.01, ** p<0.05, * p<0.1

NOTE: All predictors at their mean value

GRAPH 1: Testing parallel trend for incumbent (overall) vote share.



GRAPH 2: Testing parallel trend for Democrat incumbent vote share.



GRAPH 3: Testing parallel trend for Republican incumbent vote share.

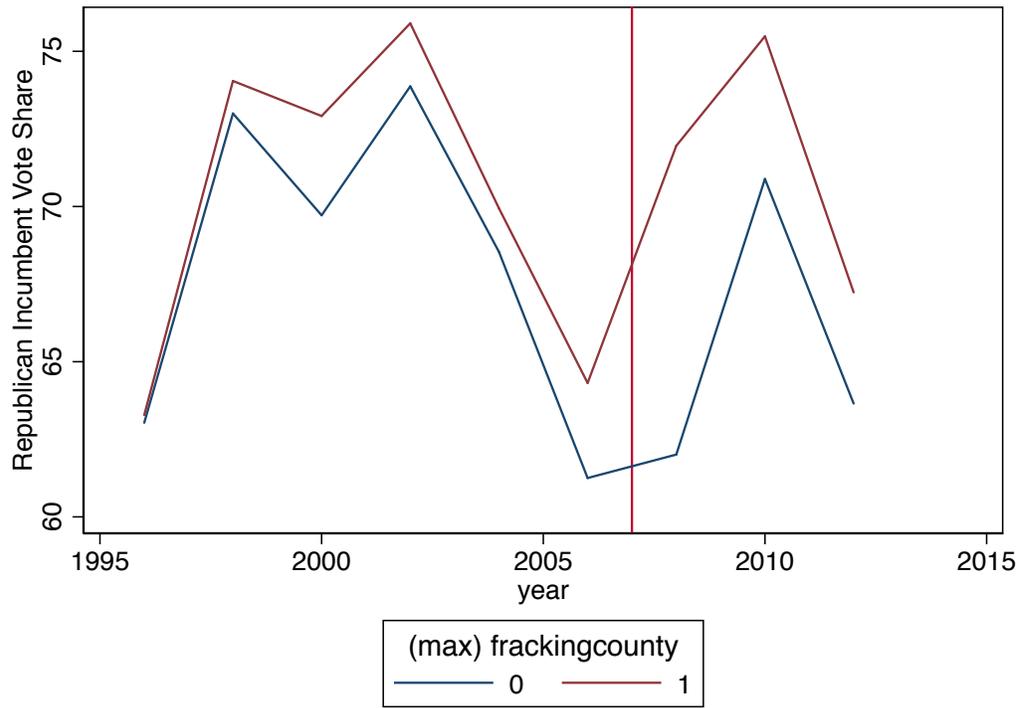


TABLE 4: Difference in Difference Model (Treatment year 2006) and data from 2003 to 2010.

VARIABLES	(1) Incumbent Vote Share	(2) Democrat Incumbent Vote Share	(3) Republican Incumbent Vote Share
Boom	-3.109*** (1.118)	-0.583 (1.757)	-5.234*** (1.452)
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Observations	1,219	579	641
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NOTE: All predictors at their mean value