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Geographic proximity to coal plants and U.S. public support for extending the Production Tax Credit

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HIGHLIGHTS

- Proximity to coal power plant increases support for Production Tax Credit.
- Attitudes toward global warming influence support for PTC.
- Raising awareness of health threat increases PTC support if living near coal plant.

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ABSTRACT

The Production Tax Credit (PTC) is an important policy instrument through which the federal government promotes renewable energy development in the United States. However, the efficacy of the PTC is hampered by repeated expirations and short-term extensions, and by the general uncertainty surrounding its future status. We examine the factors driving variation in public support for the extension of the PTC using a nationally representative, internet-based survey. Americans living near a coal-fired power plant are significantly more likely to support extending the PTC than are their peers who are more insulated from the externalities of burning coal. The evidence for this dynamic was strongest and most statistically significant among subjects experimentally primed to think about the adverse health effects of burning coal. Raising awareness of the public health ramifications of generating electricity from fossil fuels holds the potential to increase support for renewable energy policies among those living in proximity to coal plants, even in a highly politicized policy debate.

1. Introduction

Scholars have long documented strong public opposition to the construction in their local communities of essential, but potentially hazardous facilities ranging from landfills, to toxic waste processing centers, to coal and nuclear power plants (Easterling, 1992; Hunter and Leyden, 1995; Jenkins-Smith and Kunreuther, 2001). For example, in the 2008 MIT Energy Study, Ansolabehere and Konisky (2009) find that more than three quarters of Americans oppose the construction of a new coal-fired power plant within 25 miles of their home. The logic driving this opposition is clear. Many of the externalities associated with producing electricity from coal, such as exposure to airborne pollutants and contamination of water supplies with heavy metals including mercury, are borne most acutely, albeit not exclusively, by those living closest to the plants themselves (Levy and Spengler, 2002; Keeler et al., 2006; Pope et al., 2006; Chikkatur et al., 2011). In addition to adverse health effects, home prices and rents fall in the wake of a new power plant being built in the immediate vicinity (Davis, 2011).

Recent studies explore whether a similar phenomenon is driving opposition to wind energy. In the abstract, the American public strongly supports more investment in wind energy (Krohn and Damborg, 1999; Nisbet and Myers, 2007; Klick and Smith, 2010). However, many major wind energy projects arouse considerable opposition from residents of the local communities in which the wind farms would be situated (Gipe, 1995; Kontogianni et al., 2014). Though wind energy does not pose the same human health risks as energy derived from traditional fossil fuel sources, it stimulates public concerns about negative impacts on marine life and birds, an unpleasing esthetic appearance, noise from the spinning turbines, and a concomitant negative impact on local property values

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(Firestone and Kempton, 2007; Kaldellis et al., 2012; Premalatha et al., 2014; Groth and Vogt, 2014). The economic rationale behind opposition to local energy generation, whether from fossil fuels or renewable sources, is clear. Many of the costs of power generation are concentrated locally, while the benefits are distributed widely. For example, a study of opinion toward the massive Cape Wind project among residents of Cape Cod, Martha's Vineyard and Nantucket indicates that support would increase dramatically if Cape Wind was to be the first of many more large-scale wind projects, with the result being a much bigger increase in renewable energy production capacity as well as a more equitable distribution of costs (Firestone and Kempton, 2007).

Some studies find evidence consistent with a "not in my back yard" (NIMBY) effect. For example, Swofford and Slattery (2010) find that whereas 72% of their sample living between 10 km and 20 km from a wind farm supported wind energy, only 38% of those living within 5 km did so. However, other studies find little evidence of a significant relationship between proximity and opposition to wind power (Van der Horst, 2007; Ladenburg, 2008; Wolsink, 2000). Still others find a positive relationship in which residents of communities with wind farms are more supportive of wind power than residents of communities with no direct experience with the realities of wind energy (Simon, 1996; Braunholtz, 2003; Jacquet, 2012).

The bulk of extant literature examines whether proximity to a type of energy generation affects support for that form of energy. We ask a related, though distinct question: whether proximity to a traditional energy source, specifically coal-fired power plants, influences support for policies to promote safer substitutes. Specifically, we examine whether proximity to a coal-fired power plant increases support for the Production Tax Credit (PTC), which for two decades was the most important policy instrument through which the United States government endeavored to promote the growth of renewable energy.

In contrast to most European nations, such as Germany where feed-in tariff programs fostered a boon in renewable energy production, the United States relies heavily on grants and tax credits at the federal level to spur the development of alternative energy (Menz, 2005; Gan et al., 2007). One of the most important federal policy instruments to promote the growth of renewable energy is the federal Production Tax Credit (PTC), which is widely credited with fostering significant growth in wind energy by making electricity generated from wind economically competitive with that generated from conventional sources (Bird et al., 2005; Wiser et al., 2007).

However, the ephemeral nature of the PTC has undermined its effectiveness. The Energy Policy Act of 1992, which created the PTC, provided for its expiration in June of 1999. Congress has enacted legislation extending the tax credit multiple times since then. However, the credit has expired on numerous occasions before receiving congressional re-authorization. Most recently, in January 2013 Congress granted a one-year extension of the credit via the American Taxpayer Relief Act of 2012. However, the 113th Congress failed to act, and the PTC expired on December 31, 2013.

The political uncertainty surrounding the PTC has produced highly suboptimal policy outcomes. The short-term extensions and expirations of the PTC fostered a boom-bust cycle of investment in alternative energy that slowed development of American alternative energy manufacturing, increased costs, and ultimately limited generation capacity (Wiser et al., 2007; Lu et al., 2011). In a similar vein, Barradale (2010) argues that uncertainty over the PTC's future affects not only patterns of physical investment, but also contract negotiations over power purchasing agreements, which in turn hampers the development of wind energy.

Public support for the PTC is essential to securing the credit's extension and to building political pressure for a shift in policy toward a long-term tax credit that would reduce uncertainty, spur investment, and stimulate more effectively the growth of renewable energy production. Understanding the dynamics driving Americans' willingness to back measures to decrease reliance on coal is also critically important to understanding the larger contemporary political battle over the Obama administration's efforts to use the EPA to regulate power plant emissions (Weisman, 2014).

While a wealth of research explores the factors governing variation in support for renewable energy directly and various policy instruments to promote it (inter alia, Firestone and Kempton, 2007; Greenberg, 2009; Klick and Smith, 2010; Delshad et al., 2010; Cacciatore et al., 2012; Truelove, 2012), virtually no scholarship exists on the factors influencing support for the PTC and its extension. Public polling data on the PTC is also all but nonexistent. A search of the comprehensive holdings of the Roper Public Opinion Archives did not reveal a single question querying public support for the PTC and its extension.

To address this lacuna we use a nationally representative U.S. internet survey to examine public support for the PTC. We break new theoretical ground by examining whether support for the PTC is influenced by Americans' differential exposure to the externalities of coal-generated electricity. We further investigate whether any relationship between distance from coal-fired power plants and support for the extension of the PTC is moderated by an experimental manipulation administered to half of our sample specifically mentioning the adverse health effects of air pollution from coal-fired plants.

2. Hypotheses

Previous research on proximity and support for renewable energy has conceptualized the opinion formation process as a cost-benefit calculation (for an overview and critique, see Wolsink, 2000). The benefits of renewable energy, low or zero emission electricity generation, are essentially a public good. By contrast, the costs of renewable energy generation are concentrated on those who live in close proximity to the generation facility. As a result, support for renewable energy should be high in the abstract, but significantly lower among those close to a renewable facility who will pay its costs most directly. Instead of examining who pays the *costs* of renewable energy generation, we focus more intently on who stands to *benefit* the most from renewable energy. While all may benefit from renewable energy production, the benefits may be more intense for some citizens than for others.

In our current fossil fuel driven economy, those living in closest proximity to coal power plants pay a disproportionate share of the costs for obtaining cheap energy from conventional sources that produce more pollution. These individuals are more likely to benefit from increased energy production from renewable sources with fewer detrimental externalities. As a result, we hypothesize that Americans living near coal-fired power plants should be more likely, ceteris paribus, to support the extension of the PTC, which imposes costs broadly on all taxpayers to decrease the nation's dependence on fossil fuels for electricity generation. By extension, as distance from a coal burning plant increases, local exposure to the externalities of coal lessens, and support for the PTC should wane.

We further hypothesize that priming individuals to think about the public health ramifications of generating electricity from fossil fuels will strengthen the relationship between proximity to a coal plant and support for the PTC. Raising the salience of the health consequences of burning fossil fuels could conceivably increase support for renewable energy among the population as a whole. However, it should also heighten the importance of proximity, increasing the probability that those who live close to coal-fired power plants will think about the localized health consequences of

living near a coal plant and therefore become more likely to support the Production Tax Credit to spur renewable energy.

Alternately, environmental policy within the United States, particularly regarding efforts to promote renewable energy, which are inextricably linked to debates over global climate change, have become intensely politicized over time (McCright and Dunlap, 2011). Whereas the Production Tax Credit enjoyed bipartisan support in the early 1990s, by the 2010s the debate over its extension had become intensely polarized with Democrats almost unanimously in favor of it and most Republicans adamantly opposed to its extension. During the 2012 presidential election, the Republican nominee, Governor Mitt Romney, publicly opposed the extension of the Production Tax Credit, while President Obama vocally supported it (Cardwell, 2012). In February 2013, President Obama not only reiterated his support for the PTC, but also called on Congress to make it permanent (White House, 2013). Most recently, in January 2015 the Senate defeated a nonbinding amendment [S. Amdt. 133 to S.1 Keystone Pipeline Approval Act] calling for a five-year extension of the PTC. Forty-four Democrats voted for the amendment with only one opposing it. By contrast, fifty Republicans voted no while only three backed the measure.

The sharply divergent cues transmitted by Democratic and Republican elites to their co-partisans in the mass public should produce a stark partisan divide in public support for the PTC (Zaller, 1992). This suggests an alternative hypothesis: if partisan forces trump self-interest, then proximity to coal fired power plants should have little influence on support for extending the PTC after controlling for a citizen's partisan identification.

Table 1
Sample characteristics.

	2013 CCES	2010 GSS	U.S. Census
Demographics			
White	76%	77%	78%
Female	52%	57%	51%
% College degree	35%	31%	28%
Median age	52 years	49 years	37 years
Homeowner	65%	67%	64%
Christian	58%	78%	71%
Catholic	23%	23%	21%
Political characteristics			
Republican	24%	24%	
Democrat	36%	35%	
Ideology (% moderates)	36%	37%	

Comparisons are made between 2013 CCES sample demographics and demographics of 2010 General Social Survey and data from most temporally proximate United States Census publications.

3. Methodology and data

To test our hypotheses that proximity to coal-fired power plants will increase support for the PTC, particularly when Americans are primed to consider the adverse health effects produced by burning coal, we embedded an original experiment on the 2013 Cooperative Congressional Election Survey (CCES). This internet-based survey is administered by YouGov/Polimetrix and uses a two-stage sample matching methodology to produce nationally representative results from a large opt-in panel. For additional methodological details and validation information, see Ansolabehere and Rivers (2013). Our experimental module was administered to 1000 adult Americans in November of 2013. Demographic information about our survey sample and comparisons to the 2010 General Social Survey and data from the U.S. Census are provided in Table 1.

Subjects were randomly assigned to one of two experimental manipulations. Those in the control group received the following prompt: “Approximately 37% of America's electricity is generated by burning coal. In January 2013, Congress voted to extend the Production Tax Credit to encourage electricity production from renewable sources and reduce our dependence on coal. However, without additional action by Congress, this tax credit will expire at the end of the year.” The other half of the sample received an identically worded prompt with one alteration. After reading that approximately 37% of the nation's electricity is generated from coal, subjects in the health effects treatment were also told: “Scientific studies show that pollution from coal burning power plants causes tens of thousands of premature deaths in the U.S. alone every year.” In the analysis that follows, we examine both the independent influence of the health effects treatment on support for the PTC, as well as the interaction of this treatment with a subject's proximity to a coal-fired power plant.

All subjects were then asked the same question: “Do you support extending the Production Tax Credit for renewable energy?” Subjects were asked to select from three options: “yes, it should be extended”; “no, it should expire”; or “don’t know.” We constructed our dependent variable to be coded 1 if a subject supported extension, and 0 if the subject supported expiration or did not know.

Our main explanatory variable of interest is an individual's proximity to a coal-fired power plant. For each subject, the CCES provided information on the respondent's home county and ZIP code of residence. Coupling this information with data on the geographic location of coal-fired power plants allowed us to estimate the distance between each survey subject and the closest coal-fired power plant. ESRI ArcGIS 10.0 was utilized for mapping and distance calculations. The coordinates for the location of plants were determined using the 2012 Form EIA-860 Data - Schedule 2 (Plant Data). A plant was determined to be coal-powered if it was an operable plant using coal-fired fuels according to Schedule 3 (Fuel Switching Data) of the same EIA-860 form. Distance was calculated in ArcGIS using the distance between the facility's coordinates and the centroid coordinates of the respondent's ZIP code (ZIP centroids geocoded using Texas A&M Geoservices). The distribution of subjects’ estimated proximity to the nearest coal-fired power plant is plotted in Fig. 1. More than 50% of the sample lived within 28 km of a coal burning plant, with almost 75% of the sample living within 50 km of a coal burning facility. The distribution is right skewed with just over 2% residing more than 200 km from the nearest coal power plant.

Using this data, we construct three operationalizations of our independent variable of interest, proximity to a coal-fired power plant. First, we divide our sample into two halves. In this operationalization we code the 50% of our sample living below the median distance, 27.5 km, as living close to a coal-fired power plant. Those living above the median distance we code as not living close to a coal plant. This binary measure based on the distribution's median is not influenced by outlying values, and accords with prior research that operationalizes proximity as a cutoff below and above a certain threshold (Greenberg et al., 2007; Greenberg, 2009).

Just as important as actual exposure to the externalities of coal may be Americans’ *perceived* exposure to coal's costs.

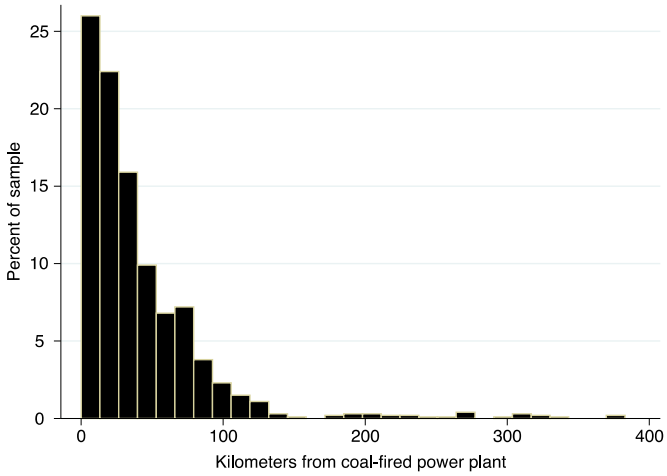

Fig. 1. Histogram of subjects' distances from coal-fired power plants.

Ansolabehere and Konisky (2009) found that more than three quarters of Americans opposed the construction of a new coal-fired power plant within 25 miles of their home. It is logical to infer that many, if not most, of these subjects believed that they would personally bear a cost to having a new coal plant located that close to their home. Accordingly, as a second test of our main hypothesis we constructed a second measure of proximity coded 1 for all subjects living within 25 miles of a coal-fired power plant. Such subjects, on average, should perceive greater costs to coal than subjects who are more geographically insulated from coal plants.

Finally, we also measure proximity continuously as each subject's distance from the nearest coal-fired power plant in kilometers. However, to insure that estimates produced from models using this continuous metric are not skewed by the handful of extreme outlying values shown in Fig. 1, we exclude from these regressions the 22 observations with individuals estimated to be more than 200 km from the nearest coal-fired power plant. These observations are more than three standard deviations above the distribution's mean.

To test our hypotheses, we construct two sets of logistic regression model to assess the influence of proximity to a coal plant on support for the extension of the PTC while controlling for a host of other factors that might influence support for renewable energy. In the first set of logistic regression models, the independent variables of interest are the three measures of proximity to a coal-fired power plant described previously. If our first hypothesis is correct, the coefficient for the two indicator variables identifying subjects who live in close proximity to a coal-fired power plant should be positive and statistically significant, while the coefficient for the raw distance that each subject lives from the nearest coal-fired plant should be negative and statistically significant.

To test our second hypothesis, we estimate an additional set of logistic regression models that interact each proximity measure with a dummy variable indicating assignment to the health effects experimental treatment group. If our hypothesis – that priming Americans to consider the adverse health effects of burning coal will heighten the influence of proximity to a coal-fired plant on support for the PTC – is correct, then the coefficients on the interactions between this indicator and the two indicator variables identifying subjects who live in close proximity to a coal-fired plant should be positive and statistically significant. The coefficient on the interaction between the health effects treatment and the distance between each subject and the nearest coal-fired power plant should be negative and statistically significant.

Finally, all of our logistic regression models control for a host of potential confounders that might also influence support for the PTC. Given the stark partisan split in Congress on legislation to continue the PTC, perhaps most importantly we control for subjects' partisan identification. Past research has found mixed results concerning whether political partisanship or ideology are significant predictors of support for green energy. For example, Klick and Smith (2010) find little evidence that partisan attachments or ideological leanings significantly shape support for wind energy (see also Ansolabehere and Konisky, 2009; Lilley and Firestone, 2013). However, both Cacciatore et al. (2012) and Delshad and Raymond (2013) find that Democrats are significantly more supportive of greater investment in energy production from biofuels than are Republicans. To examine whether support for the PTC falls along partisan lines, we include two dummy variables identifying Democrats and Republicans.[1] We also include a measure of ideological conservatism on a five-point scale.[2]

Research by Bannon et al. (2007) suggests that Americans who believe that global warming is occurring are more likely to support a range of policies to address climate change than those who are more skeptical of global warming (see also Zografakis et al., 2010). To measure Americans' attitudes toward global warming, the CCES includes a question asking subjects to select from a range of statements concerning climate change the one that best fits their view. Just under 30% of the sample agreed that "global climate change has been established as a serious problem, and immediate action is necessary." To examine whether those who believe global warming is a serious problem demanding immediate action are more supportive of the PTC than those who are more skeptical or less concerned with climate change, we include a dummy variable coded 1 for those who agreed with the foregoing statement and 0 for those who did not.

Finally, our logistic regressions include a number of demographic controls including measures of age, gender, educational attainment, race, home ownership, religious affiliation, and religiosity. Past research on whether older Americans are more or less supportive of renewable energy yields mixed results (e.g. Firestone and Kempton, 2007; Ladenburg, 2008; Klick and Smith, 2010), although older Americans often appear to be more supportive of electricity generation from fossil fuels than younger Americans (e.g. Ansolabehere and Konisky, 2009; Greenberg, 2009; Boudet, et al., 2014). Thus, it is possible that older Americans will be less supportive of extending the PTC than younger Americans. Several past studies show that support for various forms of renewable energy increases with education (Firestone and Kempton, 2007; Klick and Smith, 2010); as a result, we expect higher levels of educational attainment to increase a subject's probability of supporting the PTC. Similarly, because white Americans are more supportive of renewable energy technologies than non-whites (Ansolabehere and Konisky, 2009; Greenberg, 2009), we expect whites to be more supportive of extending the PTC, all else being equal, than non-whites.

Prior research looking for evidence of a gender gap in support for renewable energy offers mixed results (Ansolabehere and Konisky, 2009; Klick and Smith, 2010; Cacciatore et al., 2012; Cacciatore et al., 2012). Ansolabehere and Konisky (2009) explore

[1] True independents, subjects who "leaned" toward one party or the other, and the fewer than 4% who said they were "not sure" of their partisan affiliation make up the omitted baseline category. Recoding "leaners" as partisans yields substantively similar results.

[2] Fewer than 9% of subjects replied that they were "not sure" of where to place themselves on a five-point ideology scale (ranging from "very liberal" to "very conservative"). We have recoded these subjects as moderates (almost two thirds of these subjects also replied that they were true independents or unsure of their party identification). Replicating all of our analyses excluding these subjects, or excluding the ideology variable, yields substantively similar results.

whether home owners have systematically different energy policy preferences than non-home owners, but find mostly null results. Some prior research has examined the influence of income on support for renewable energy. However, because more than 10% of our sample declined to answer the self-reported income question on the CCES, we have opted not to include it in the models below.[3]

Some past research also finds significant correlations between religious affiliation and religiosity and support for renewable energy. For example, Klick and Smith (2010) find some evidence that Christians in general and Catholics in particular may be more supportive of wind energy than those from other or no religious faith background. Similarly, Greenberg (2009) finds that religiosity is a significant predictor of support for energy production from fossil fuels, and is negatively, though not significantly, related to support for renewable sources. To examine whether similar dynamics hold in the context of support for the PTC, we include two dummy variables identifying all Christians and Catholics, as well as a measure of religiosity taken from Pew on a four point Likert scale ranging from religion being not at all important (1) to very important (4).

4. Results and discussion

In the aggregate, just over 56% of our nationally representative sample of Americans supported the extension of the Production Tax Credit. This figure is strikingly lower than the lofty levels of support for renewable energy in the abstract often observed in other studies. For example, Nisbet and Myers (2007) review surveys showing more than three quarters of Americans favor greater public investment in wind and solar energy. Similarly, Klick and Smith (2010) find strong majorities favoring increasing the United States' capacity to develop electricity from wind, with less than 5% openly opposing the expansion of the wind energy sector. However, with respect to one of the main policy instruments through which the federal government has sought to spur growth in wind and other renewable energy sources, only a scant majority backed the policy's continuation.

Furthermore, although not our main theoretical focus, a simple comparison of means in the control group and health effects treatment suggests that the invocation of adverse health effects of generating electricity from coal did little to rally support for alternative energy. Support for extending the PTC in the control group averaged 54.5% versus 57.6% in the health prime treatment.

4.1. Proximity and support for PTC

As an initial test of our first hypothesis that proximity to a coal-fired power plant increases the probability of a subject supporting the extension of the PTC, we constructed a set of logistic regression models including our three operationalizations of proximity along with the full set of demographic and other control variables described in Section 3.[4] Table 2 presents the results. The logistic regression model in column 1 uses a binary measure of proximity, which allows examination of whether those living "close" to a coal-fired power plant – defined here as living within 27.5 km (17.1 mi) of the plant, which categorizes half of the respondents in our sample – are more likely to support the extension of the PTC, all else being equal, than subjects who live further than this distance from the nearest coal-fired plant. The relevant coefficient is positive and statistically significant. Subjects who live close to a coal-fired power plant are significantly more likely to support the extension of the PTC than those who live further from a plant burning coal.[5]

The model in column 2 employs a broader definition of proximity, that is, subjects living within 25 miles (40.2 km) of a coal-fired power plant, corresponding to the proximity measure used in Ansolabehere and Konisky's (2009) work. This model yields virtually identical results to the first. Most importantly, the coefficient for this alternative operationalization of proximity is positive and statistically significant ($p=.056$).

Finally, the logistic regression model in column 3 uses an alternate, continuous operationalization of proximity: each subject's distance in kilometers from the nearest coal-fired power plant. Consistent with expectations, the coefficient is negative and statistically significant. The further a subject lives from a coal power plant, the less likely he or she is to support extending the PTC.

Many of the control variables also have the expected relationships with support for extending the PTC. Most importantly, we observe stark political divides. Democrats in our sample were much more likely to support the extension of the PTC than either Republicans or Independents. Similarly, as a subject's ideological conservatism increases, his or her probability of supporting the PTC decreases precipitously.

Perhaps unsurprisingly, Americans who are convinced by the scientific evidence for global climate change and who believe that urgent action is required to address it are also significantly more likely to support extending the PTC than those who are not convinced by the evidence for climate change, even after controlling for partisan affiliation. Support for extending the PTC also increases significantly with an individual's level of educational attainment. White Americans are more supportive, on average, of extending the PTC than non-whites, all else being equal. None of the coefficients for the other independent variables meet conventional levels of statistical significance. Neither age, nor gender, nor home ownership, nor religion affects the probability of supporting the PTC.

Finally, each of the models in Table 2 includes an indicator variable that identifies subjects assigned to the health effects experimental treatment. In each model, the relevant coefficient is positive, and in model 3 it only narrowly fails to reach conventional thresholds of statistical significance. However, even here the estimated substantive impact of the health effects treatment overall was somewhat modest. Simulations from the results in model 3 show that receiving the health effects prime increased the probability of the median independent subject supporting the PTC by approximately .06.

4.2. Health effects treatment as a moderator of proximity

Priming Americans to consider the adverse health consequences of burning coal appears to have only a modest positive impact on support for the extension of the PTC in the aggregate. However, we hypothesized that the health effects prime may also moderate the influence of proximity on support for the PTC. To test our hypothesis that the health effects treatment will strengthen the relationship between an individual's proximity to coal and support for the PTC, Table 3 presents a second set of logistic regression models interacting each proximity measure with two

[3] Replicating the analyses in Tables 2 and 3 with the income measure and dropping those observations with missing income data yields substantively similar results.

[4] As a robustness check, we constructed an ordinal dependent variable coded 3 for those that supported extension; 2 for those who did not know; and 1 for those who favored expiration. Ordered logit analyses using this alternate operationalization of the dependent variable yield substantively similar results.

[5] As a robustness check, we also re-estimated this model using alternate cut-offs obtained from the literature, such as 20 km (Swofford and Slattery, 2010), to define subjects as living in close proximity to a coal-fired power plant. These models yield substantively similar results to those presented here.

Table 2
Factors driving support for extension of Production Tax Credit.

	(1)	(2)	(3)
Close to power plant (within 27.5 km)	0.321**		
	(0.142)		
Close to power plant (within 25 miles)		0.283*	
		(0.148)	
Distance from plant (in 100s km)			−0.411*
			(0.229)
Health treatment	0.192	0.185	0.226
	(0.141)	(0.141)	(0.143)
Republican	0.073	0.079	0.058
	(0.190)	(0.190)	(0.193)
Democrat	0.662***	0.671***	0.666***
	(0.175)	(0.175)	(0.176)
Conservative ideology	−0.390***	−0.398***	−0.384***
	(0.093)	(0.093)	(0.093)
Concerned with global warming	0.891***	0.891***	0.896***
	(0.179)	(0.179)	(0.180)
Education	0.181***	0.180***	0.177***
	(0.049)	(0.049)	(0.049)
Age	−0.002	−0.002	−0.001
	(0.005)	(0.005)	(0.005)
White	0.371**	0.375**	0.311*
	(0.176)	(0.176)	(0.177)
Female	0.055	0.035	0.059
	(0.146)	(0.146)	(0.148)
Homeowner	0.180	0.176	0.181
	(0.159)	(0.159)	(0.160)
Religiosity	0.014	0.013	0.007
	(0.079)	(0.079)	(0.080)
Christian	−0.098	−0.082	−0.091
	(0.193)	(0.193)	(0.195)
Catholic	−0.148	−0.153	−0.141
	(0.186)	(0.187)	(0.188)
Constant	−0.172	−0.172	0.119
	(0.430)	(0.435)	(0.425)
Observations	998	998	976

Coefficients from logistic regression models with standard errors in parentheses. Dependent variable is support for extending the Production Tax Credit. In model 1, the close to power plant variable is coded 1 for subjects living at or below the median distance (27.5 km) from a coal-fired power plant. In model 2 the close to power plant variable is coded 1 for subjects living within 25 miles of a coal-fired power plant. In model 3, a continuous measure of distance is used, though outlier subjects living more than 200 km from a coal power plant are omitted. All significance tests are two-tailed.

*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.10$.

Table 3
Proximity and support for PTC across experimental conditions.

	(1)	(2)	(3)
Within 27.5 km * Control	0.223		
	(0.199)		
Within 27.5 km * Health treatment	0.420**		
	(0.200)		
Within 25 miles * Control		0.083	
		(0.208)	
Within 25 miles * Health treatment		0.481**	
		(0.207)	
Distance from plant (in 100s km) * Control			0.015
			(0.339)
Distance from plant (in 100s km) * Health treatment			−0.757**
			(0.312)
Health treatment	0.097	−0.069	0.509**
	(0.196)	(0.233)	(0.220)
Republican	0.068	0.079	0.058
	(0.191)	(0.191)	(0.193)
Democrat	0.663***	0.671***	0.665***
	(0.175)	(0.176)	(0.177)
Conservative ideology	−0.387***	−0.396***	−0.384***
	(0.093)	(0.093)	(0.094)
Concerned with global warming	0.890***	0.894***	0.886***
	(0.179)	(0.179)	(0.180)
Education	0.180***	0.182***	0.180***
	(0.049)	(0.049)	(0.049)
Age	−0.002	−0.002	−0.001
	(0.005)	(0.005)	(0.005)
White	0.374**	0.382**	0.324*
	(0.176)	(0.176)	(0.177)
Female	0.055	0.038	0.066
	(0.146)	(0.146)	(0.148)
Homeowner	0.173	0.169	0.172
	(0.159)	(0.159)	(0.161)
Religiosity	0.014	0.013	0.005
	(0.079)	(0.079)	(0.080)
Christian	−0.102	−0.092	−0.104
	(0.194)	(0.194)	(0.196)
Catholic	−0.149	−0.149	−0.135
	(0.186)	(0.187)	(0.188)
Constant	−0.133	−0.049	−0.035
	(0.433)	(0.443)	(0.435)
Observations	998	998	976

Coefficients from logistic regression models with standard errors in parentheses. Dependent variable is support for extending the Production Tax Credit. All significance tests are two-tailed.

*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.10$.

dummy variables indicating whether the subject was in the control or health effects treatment group.[6]

The first column presents the results when using the median distance (27.5 km) as the cutoff for our binary measure of proximity. The coefficient on the first interaction identifying those living close to a coal-fired plant in the control group is positive; however, it fails to reach conventional levels of statistical significance. The coefficient on the second interaction identifying those living close to a coal-fired plant in the health effects treatment group is also positive, substantively larger, and statistically significant. This is strongly consistent with our second hypothesis that the health effects prime would strengthen the effect of proximity on support for the PTC. However, a wald test cannot reject the null that the coefficient for proximity in the health effects treatment, while larger in magnitude, is not statistically greater than the coefficient for proximity in the control group. Thus, while the effect of proximity is statistically greater than 0 in the health effects treatment, this positive coefficient is not statistically greater than the positive coefficient observed in the control group.

The second column presents results from an otherwise identical model using our alternate binary measure of proximity: whether each subject lives within 25 miles of a coal-fired power plant. Results are similar to those observed in column 1. The coefficient for proximity in the control group is positive, but substantively small and not statistically significant. However, the coefficient for proximity among subjects who received the health effects treatment is positive, larger, and statistically significant.[7]

[6] The results are equivalent to those obtained by simply including each proximity measure (i.e. the main effect) and its interaction with the health effects treatment dummy as all subjects are either in the treatment or the control group. This presentation simply aids interpretation of the results.

[7] However, a wald test, again, cannot reject the null hypothesis that the two coefficients are of equivalent magnitude. The positive coefficient on the *Within 25 miles * Health treatment* variable is significantly greater than 0, but not significantly

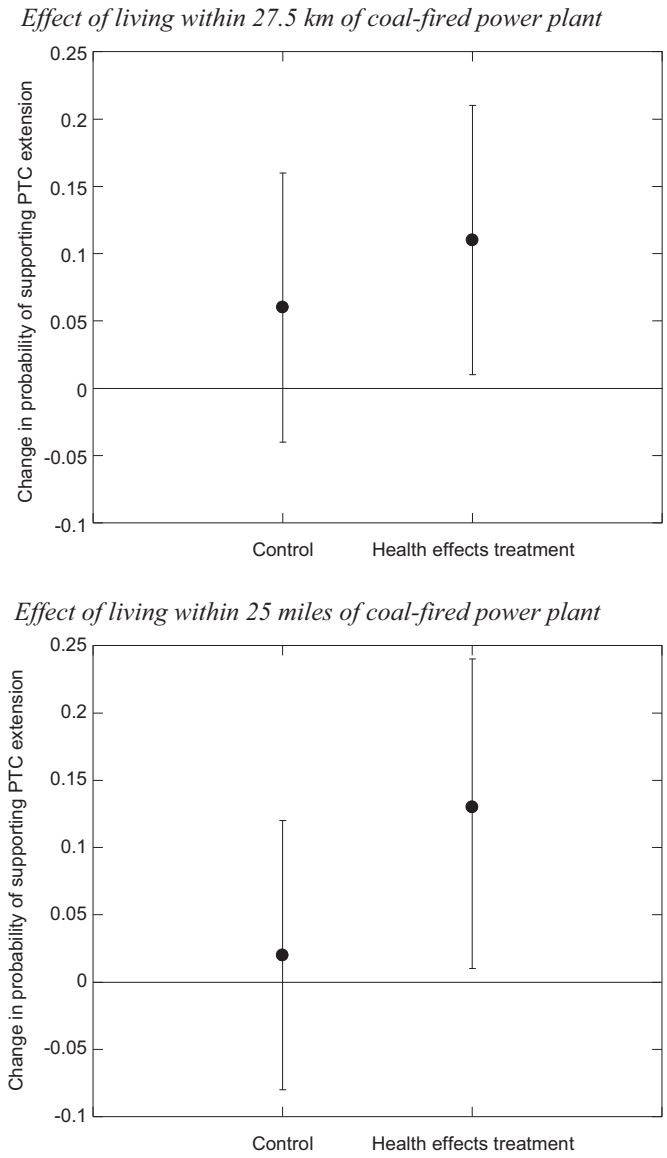

Fig. 2. Effect of proximity on support for extending PTC by experimental condition. Note: I-bars illustrate 95% confidence intervals around each point estimate. Data obtained from simulations of models 1 and 2 of Table 3.

First differences derived from simulations illustrate the magnitude of the effect of proximity on willingness to support the extension of the PTC across the control and health effects treatment conditions while holding all other variables constant at their median values. As shown in the top panel of Fig. 2, the model in column 1 predicts that living close to a coal-fired power plant (defined as living closer than the median distance of 27.5 km) increases the predicted probability of the median subject in the control group supporting the extension of the PTC by roughly .06. However, there is considerable uncertainty around that estimate and the 95% confidence interval spans zero. The estimated effect of proximity in the health effects treatment group was larger. For the median subject in the treatment group, proximity to a coal plant increases the predicted probability of supporting the extension of the PTC by approximately .12, all else being equal. Moreover, this estimated effect is statistically significantly greater than zero. Yet, the estimated effect in the health effects treatment group is not significantly greater than the estimated positive effect for the control group (i.e. the 95% confidence interval includes the point estimate for the effect of proximity in the control group). The bottom panel of Fig. 2, which illustrates the effect sizes derived from model 2 (operationalizing proximity as living within 25 miles of a coal-fired power plant), yields a similar pattern. The estimated effect of proximity in the control group is positive, but small and not statistically significant. By contrast, subjects living near a coal plant are much more likely to support the extension of the PTC in the health effects treatment group, though the difference in magnitude from that observed in the control group is not quite statistically significant.

Thus, using two different binary measures of proximity to the nearest coal-fired power plant yields considerable support for both of our main hypotheses. In the aggregate, Americans who live closer to coal plants and experience the externalities of burning coal most acutely are more supportive of policy measures to increase the use of renewable energy sources than are those who are more geographically insulated from these costs. Moreover, this relationship is particularly strong when subjects are primed to consider the health ramifications of burning coal, which is estimated to cause tens of thousands of premature deaths in the United States annually. Indeed, it is only among subjects in the health effects treatment group that the estimated effect is statistically significant.

Finally, in column 3 of Table 3 we estimate a third logistic regression using interactions with the continuous measure of distance from the nearest coal-fired power plant. When using this continuous measure of proximity, a similar pattern emerges. In the control group, we see little evidence of a relationship between distance from a coal-fired power plant and support for extending the PTC. The coefficient for the relevant interaction is actually positive, but substantively very small and statistically insignificant. However, among subjects in the health effects treatment group, the coefficient for distance from a coal plant is strongly negative and statistically significant. That is, the further a subject lives from a coal plant, the less likely he or she is to support extending the PTC for renewable energy generation, all else being equal.

Fig. 3 illustrates the magnitude of the effect of distance from the nearest coal power plant on the opinions of the median

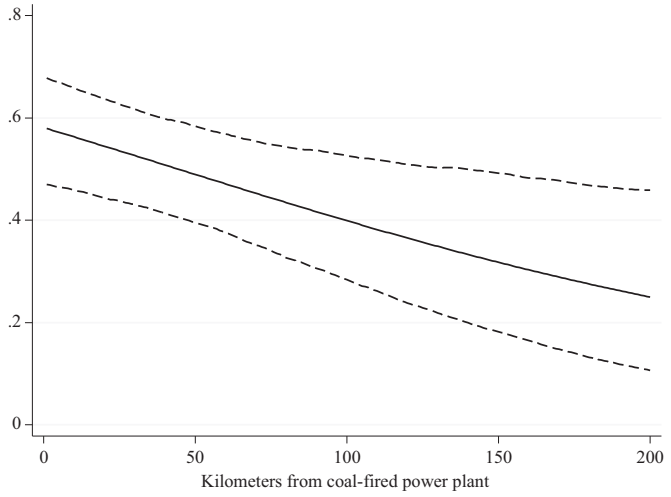

Fig. 3. Effect of distance on support for extending PTC, Health Effects Treatment. Note: The solid line indicates predicted probabilities of supporting the extension of the PTC at various distances from the nearest coal-fired power plant. The dashed lines indicate the 95% confidence interval around these estimates. Data obtained from simulations of model 3 of Table 3.

(*footnote continued*)
greater than the coefficient for the *Within 25 miles * Control* variable.

Independent respondent in the health effects treatment group. For the median Independent living within a few kilometers of a coal-fired power plant, the predicted probability of supporting the extension of the PTC is approximately .58. The model suggests that moving the same subject to 50 km from the nearest coal plant would decrease support for extending the PTC to approximately .49. Moving the same subject another 50 km away from the nearest plant reduces the predicted probability of backing an extension of the PTC further still to approximately .40. At the tail of the distribution, the predicted probability of the median Independent supporting the extension of the PTC is no greater than 1 in 4.

5. Conclusions and policy implications

A wealth of recent scholarship examines whether proximity to facilities that generate renewable electricity influences public support for the use of that technology (Van der Horst, 2007; Jones and Eiser, 2010; Swofford and Slattery, 2010; Kaldellis et al., 2013; Kontogianni et al., 2014; Groth and Vogt, 2014). Our analysis reminds policymakers that proximity to traditional facilities burning fossil fuels to produce electricity also shapes the public's renewable energy policy preferences. In contrast to Greeenberg (2009), who finds few systematic differences in support for increasing the nation's reliance on nuclear, natural gas, or renewable fuels between those who live near specific sites with existing or planned nuclear power plants or waste management sites and those who do not, we find that the proximity with which subjects live to a coal-fired power plant significantly influences many Americans' likelihood of supporting the extension of the Production Tax Credit. Among the half of our sample modestly primed to think about the adverse health consequences of burning coal, Americans who live closer to a coal-fired power plant are significantly more likely to support extending the PTC than are their peers who live in communities more geographically distant from a coal plant.

This suggests an important contextual component to how Americans form their energy policy preferences. Past scholarship documents how most Americans possess limited knowledge about energy production, whether it is from renewable sources or fossil fuels (e.g Boudet et al., 2014; Klick and Smith, 2010). As such, local context may serve as an important heuristic, at least when citizens are primed even indirectly to consider potential local impacts. Americans who live near a coal-fired power plant may logically be both more aware of and more responsive to information concerning the health, environmental, and economic costs of burning coal than those who are geographically removed from many of the costs imposed by coal. As such, these Americans become more supportive of federal tax incentives to spur renewable energy growth than those who fare better under the current system. However, the political impact of this greater support for renewable energy among those who bear the costs of producing electricity from coal most acutely is blunted by the reality that such plants are sited disproportionately in socioeconomically disadvantaged communities and in minority communities (Davis, 2011).

Of course, it is important to emphasize that proximity to coal-fired power plants and the potential to raise support for alternative energy by priming citizens who live near such plants to consider the adverse health effects of generating electricity from coal is far from the most important determinant of support for the PTC. Our survey results plainly illustrate the extent to which the policy debate over the future of the PTC is politicized among the mass public. Whereas more than 70% of Democrats backed extending the PTC, just under 50% of Independents followed suit, and only 42% of Republicans supported extending the credit. Indeed, a large partisan split persists even after controlling for beliefs about global warming, which also fall along party lines; Democrats are eight times more likely to agree that global climate change is an exigent problem demanding action than are Republicans in our survey.

This stark partisan divide over a major federal policy instrument to promote renewable energy contradicts the rather modest partisan differences that previous studies observe in support for renewable energy in the abstract (Ansolabehere and Konisky, 2009; Klick and Smith, 2010). This disparity is a testament to the extreme power of politicization to significantly erode popular support for renewable energy (in the context of nuclear energy, see also Bolsen et al., 2014).

In the abstract, renewable energy is a non-partisan commodity. However, policy instruments like the PTC can quickly become politicized. As discussed, most scholars argue that a permanent extension of the credit would produce more efficient policy outcomes than the current system of short-term expirations and extensions that is clouded in uncertainty (Wiser et al., 2007; Barradale, 2010; Lu et al., 2011). However, as the PTC has become a battleground for partisan warfare in Washington, support for the measure in the mass public has also split along partisan lines.

In an environment where most aspects of energy policy are intensely politicized, building strong levels of public support for policies that promote the growth of renewable energy is difficult. However, this analysis suggests two possible pathways to growing support for such policies. First, even modest information campaigns about the adverse health effects of burning coal may be sufficient to raise support for renewable energy policies among those most directly affected by coal power – those who live in close proximity to coal plants. A second and more difficult path is to heighten awareness of the externalities of electricity production from fossil fuels much more broadly among those who are normally geographically insulated from them. The modest health effects treatment in our experiment had no effect on the policy preferences of citizens who did not live close to a coal-fired plant. This suggests that a truly effectual information campaign would have to be extensive and far-reaching. Nevertheless, raising awareness and appreciation of these externalities would also serve the goal of environmental justice, as those most acutely affected by the costs of coal – the poor and racial minorities – are those with the least voice in our democratic system (Schlozman et al., 2012; Gilens, 2014.).

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