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BUSINESS CYCLE EFFECTS ON CONCERN ABOUT CLIMATE CHANGE: THE CHILLING EFFECT OF RECESSION

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This paper uses two different sources of data to investigate the association between the business cycle — measured with unemployment rates — and public concern about climate change. Building on recent research that finds internet search terms to be useful predictors of health epidemics and economic activity, we find that an increase in a state's unemployment rate decreases Google searches for "global warming" and increases searches for "unemployment," and that the effect differs according to a state's political ideology. From national surveys, we find that an increase in a state's unemployment rate is associated with a decrease in the probability that residents think global warming is happening and reduced support for the U.S. to target policies intended to mitigate climate change. We also examine how socio-demographic characteristics affect opinions about whether climate change is happening and whether government should take action. Beyond providing the first empirical estimates of macroeconomic effects on concern about climate change, we discuss the results in terms of the potential impact on environmental policy and understanding the full cost of recessions.

1. Introduction

This paper investigates the relationship between the macroeconomic business cycle and public concern about climate change. The fact that both have undergone such remarkable changes in recent years provides a unique opportunity to evaluate how economic conditions affect public opinion about what has emerged as one of the more controversial and important policy issues that we face.

It is well-known that the end of 2007 was the beginning of the most significant economic downturn in the United States since the Great Depression. Throughout much of 2008 and 2009 gross domestic product (GDP) experienced negative growth, and unemployment rates are now more than double what they were in early 2007. At the same

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time, we have witnessed a substantial erosion in public concern about environmental issues. Polling results from the Pew Research Center (2009) on what has become the headline issue of climate change indicate that between April 2008 and October 2009, the percentage of Americans believing in solid evidence that the earth is warming decreased from 71 to 57 percent (a decline of 14 percent); and those thinking climate change is a very serious problem decreased from 44 to 35 percent (a decline of 9 percent).

In this paper we investigate how changes in economic conditions — proxied with unemployment rates — affect different indicators of concern about climate change. We test the overarching hypothesis that worsening economic conditions erode concern about climate change. One way to conceptualize the analysis is testing psychology theory on Maslow's (1943) hierarchy of needs, whereby it is only after basic and immediate economic needs are met that individuals concern themselves with more long term and abstract issues. For example, during a recession, households may focus on things like employment rather than more long term and uncertain threats such as climate change. If this occurs, as we discuss later in the paper, there are potential feedbacks that reinforce the relationship through the media and social interactions, along with causing immediate and long term policy implications.

We first use data on keyword searches through the Internet as complied by Google Insights for Search. Researchers are beginning to use these data as a leading indicator of what issues the public is concerned about; for example, keyword searches for "swine flu" in specific areas at specific points in time have been used as predictors of actual flu activity (Pelat *et al.*, 2009; Valdivia and Monge-Corella, 2010).[1] Recent studies have also shown that Google search is a powerful tool for predicting economic activity such as product demand for automobiles, home sales, retail sales, and travel behavior (Chaoi and Varian, 2009). Using panel data by month for each state, we find that an increase in a state's unemployment rate is associated with a decrease in keyword searches within the state for "global warming" and an increase in searches for "unemployment." We also find that in more Democratic leaning states, the decline in global-warming searches is larger, whereas the increase in unemployment searches is smaller.

The second part of our analysis uses two waves of a survey conducted by the Yale Project on Climate Change Communication in October 2008 and January 2010. The surveys were based on a national sample and were designed to gauge public opinion about climate change. We take advantage of questions that were asked in both waves of the survey, which enables estimation of pooled cross-sectional models, some of which include a variable for the state unemployment rate, controls for respondent characteristics, and state fixed effects. The main results indicate that an increase in a state's unemployment rate is associated with a decrease in several areas of concern related to climate change. These range from whether respondents think global warming is

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[1]Maps that show search trends for the flu and how they are used to predict actual flu activity worldwide are available at http://www.google.org/flutrends/.

happening to whether the government should be doing more or less to address the problem. We also examine how socio-demographic characteristics affect opinions about the same questions.

Together, the two sets of results reveal a strong association between business cycles, as proxied by state unemployment rates, and concern about climate change. Each piece of evidence that we present has advantages and limitations, both of which we discuss in more detail later in the paper. But the general pattern is clear: higher unemployment rates — at least when levels reach those observed during the recent recession — erode public concern about climate change.

While there is a sizable literature on public opinion about the environment, we are not aware of any studies using comparable data sets that investigate the influence of macroeconomic trends. Instead, much of the research is focused on how environmental concern is shaped by demographic characteristics (e.g., Van Liere and Dunlap, 1980; Elliott *et al.*, 1995), political party affiliation (e.g., Dunlap *et al.*, 2008; McCright and Dunlap, 2011), international differences (e.g., Bloom, 1995), media coverage (e.g., Shanahan *et al.*, 1997), and recent weather shocks (Owen *et al.*, 2010). Other studies have examined the influence of environmental public opinion on public policy (e.g., Dunlap, 1995).[2] More related to our study, because it considers a macro-economic variable, is a paper by Elliott *et al.* (1997) that finds evidence of a positive correlation between per capita disposal income and survey questions about whether respondents think government should spend more on improving and protecting the environment. Caution should be taken when interpreting these results, however, as they are based on a time series of only 38 data points representing national averages.

The present paper also contributes to the literature on the cost of recessions. While much attention is given to costs related to consumption declines, real estate equity lost, health, and labor, the environmental costs of recessions have gone unrecognized.[3] Climate change mitigation is an especially difficult political issue because greenhouse-gas emissions represents a global public bad. Hence the free rider challenge is hard to surmount and a deep recession only diminishes the chances that a nation will unilaterally adopt costly actions whose private benefits are perceived to be low.

A specific example of how recessions can impact carbon mitigation policy is the implementation of California's climate-change policy (AB32). In fact, in November 2010, the people of California voted on a proposition (Proposition 23) to delay the state's implementation of AB32 until the statewide unemployment rate is reduced below 5.5 percent.[4] The proposition failed to pass, but its supporters used the ongoing recession to galvanize support and generate concern, namely that the state's unilateral cap-and-trade policy would raise local electricity prices and promote job leakage as

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[2]See Dunlap and Mertig (1992) for a book with several contributed chapters focusing on various trends in environmental concern in the United States.

[3]Environmental benefits may also occur during recessions, perhaps most importantly because of lower pollution emissions due to diminished economic activity (Kahn, 1999; Chay and Greenstone, 2003).

[4]For the proposition itself, see http://ag.ca.gov/cms_attachments/initiatives/pdfs/i902_initiative_09-0104.pdf.

energy intensive businesses migrate away from California to states with a lower cost of doing business. In 2011, this ongoing concern has led the California Air Resources Board (the regulatory agency with the responsibility to implement AB32) to proceed more cautiously as it rolls out the nascent state-level, cap-and-trade policy.

The remainder of the paper is organized as follows. The next section presents the analysis of Google keyword searches, and Section 3 presents the analysis of national survey data on public opinion about climate change. Section 4 concludes with a summary, discussion of policy implications, and directions for future research.

2. Google Keyword Searches

Google Insights for Search is a publicly available online tool for tracking aggregate Google search activity over time for specific geographic areas such as states.[5] As mentioned previously, recent research shows that Google search terms are a powerful tool to predict public health epidemics and economic activity. Here we use Google searches to investigate how changes in the business cycle affect internet search activity related to climate change. In particular, we use Google Insights to create a weekly database from January 2004 through February 2010 of searches for two words — "global warming" and "unemployment" — by state. The basic idea is to analyze how changes in a state's unemployment rate affect search activity for these two keywords. We hypothesize that increases in a state's unemployment rate will result in fewer searches for "global warming."[6] We also hypothesize that increases in a state's unemployment rate will increase searches for "unemployment."

The data available on Google Insights is not the actual number of keyword searches, but rather a scaled variable that enables relative comparisons of trends through time within a keyword and also between keywords. Figure 1 illustrates the raw data comparing relative search activity for global warming and unemployment for the entire U.S. from January 2004 through February 2010. For purposes of our analysis, we standardize the search frequency data by keyword and by state. This means that the search data is distributed $N[0,1]$ for each keyword over time within each state. We follow this procedure because our identification strategy is based on variation within a state, and the uniform scaling facilitates comparison of magnitudes between the different keywords of global warming and unemployment.[7] Along with these weekly internet search data we merge corresponding monthly state unemployment data from

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[5]Google Insights for Search is available online at http://www.google.com/insights/search/#.

[6]We also examined other search terms such as "climate change" but the search volume for this more nuanced term is comparatively very low.

[7]We exclude some observations because of a high frequency of zeros for small states such as North Dakota. In particular, we drop observations for a given week if both the global warming and unemployment search volume is zero. This leads us to drop 250 observations (only 1.8 percent of the data), and most of the dropped observations are from the year 2004, the first year that Google Insights reports search volume. We also exclude Wyoming from the analysis because of some peculiarities of the data for that state. The main results, however, do not change with inclusion of these dropped data.
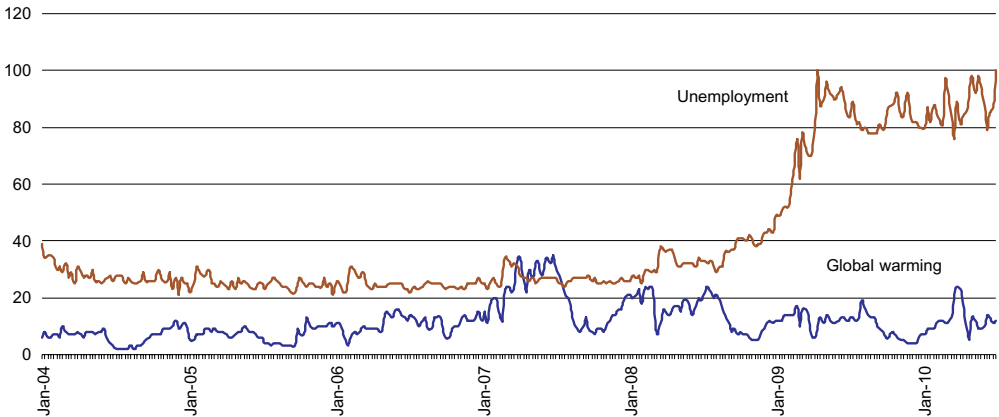
Figure 1. Comparison of keyword searches for "global warming" and "unemployment" for the United States as a whole between January 2004 and February 2010. Data collected using Google Insights for Search and scaled between 0 and 100.

the Bureau of Labor Statistics. These data are the seasonally adjusted unemployment rates reported as a percentage.[8] The mean unemployment rate in the data is 5.638 percent with a standard deviation of 2.049.

To study the relationship between a state's unemployment rate and a state's weekly internet search activity, we estimate models of the form

$$Search_{itk} = \beta Unemployment\_rate_{it} + \nu_i + \mu_t + \varepsilon_{itk}, \tag{1}$$

where i indexes states, t indexes each month-year, k indexes week of the month, $Search_{it}$ is the standardized variable for either global warming or unemployment searches, ν_i is a unique intercept for each state, μ_t is a unique intercept for each month-year, and ε_{ijk} is a normally distributed error term. The coefficient of interest is β, as it provides an estimate of how, on average, changes in a state's unemployment rate affect keyword search activity within that state. The key advantages of the model is that identification comes from variation within a state, after controlling for changes through time that are common to all states, such as macro-economic trends, new information, heat waves, and cultural events, e.g., Al Gore's Nobel Prize in 2007. That is, within states, we estimate how changes in a state's unemployment rate affects changes in keyword search activity. We estimate the models with the fixed effects estimator weighted by each state's population in 2000, and we report standard errors clustered at the state-month-year, reflecting the unit at which the unemployment data varies.

Table 1 reports the results for global warming and unemployment in columns (1) and (3), respectively. The coefficient on the unemployment-rate variable is highly statistically significant in both the global warming and unemployment models, and as hypothesized, it has the opposite sign between the two models. Higher unemployment

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[8]The data are available online at http://www.bls.gov/lau/.

Table 1. Fixed effects models of Google keyword searches.

	Global warming		Unemployment	
	(1)	(2)	(3)	(4)
Unemployment_rate	−0.052***	0.238***	0.060***	0.122***
	(0.012)	(0.027)	(0.019)	(0.040)
Unemployment_rate×Kerry	–	−0.575***	–	−0.123*
		(0.057)		(0.072)
Constant	−0.677***	−0.723***	−0.474***	−0.484***
	(0.096)	(0.086)	(0.158)	(0.156)
Month-year dummies	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
R-squared (adjusted)	0.730	0.735	0.919	0.919

Notes: All models are based on 13,890 observations. The dependent variables are relative frequency of Google searches for the corresponding keyword standardized by keyword and state. The mean for *Unemployment_rate* is 5.638, and the mean for *Kerry* is 0.468. Standard errors clustered at the state-month-year are reported in parentheses. Three, two, and one asterisk(s) indicate statistical significance at the 99-, 95- and 90-percent levels, respectively.

rates decrease internet search activity for global warming, but increase search activity for unemployment. Based on this revealed preference for interest in global warming, therefore, it appears that recessions crowd out concern for the environment, while not surprisingly increasing concern about unemployment.

Given the well-known ideological divide between "Red States" and "Blue States" on environmental issues, we also explore how overall state political ideology affects the association between state unemployment rates and Google searches. While there exists evidence on increasing political polarization about climate change (McCright and Dunlap, 2011), our analysis differs because we relate it to changes in macroeconomic conditions. For each state, we collected additional data on the share of votes cast for the Democrat John Kerry in the 2004 Presidential Election. We define this variable as *Kerry*, and across the states it has a mean of 0.468 and standard deviation of 0.082. With the new variable, we estimate an augmented version of the previous model:

$$Search_{itk} = \beta_1 Unemployment\_rate_{it} + \beta_2 Unemployment\_rate_{it} \times Kerry_i + \nu_i + \mu_t + \varepsilon_{itk},$$

(2)

where the coefficient on the interaction, β_2, indicates how the marginal effect of a state's unemployment rate on Google searches differs with different political ideology within a state. Note that $Kerry_i$ does not enter the model independently because, due to its time invariance, it is perfectly collinear with the state fixed effects.

Table 1 reports the augmented-model results in columns (2) and (4). The coefficient on the interaction is negative and statistically significant in both cases, though only at

the 90-percent level for the unemployment model. With respect to the global-warming model, the result is interpreted such that, on average, increases in a state's unemployment rate reduce the number of Google searches for global warming within the state, but the reduction is larger in states that lean more Democratic. Hence it appears, perhaps somewhat counter-intuitively, that concern about global warming is more negatively correlated with the business cycle in states that lean democratic rather than republican. This is consistent with the observation that Republican concern about climate change is simply lower and perhaps less variable with the business cycle over the time period that we study. With respect to the model for internet searches on unemployment, the result implies that, on average, increases in a state's unemployment increase the number of Google searches for unemployment, but the increase is lower in states that lean more Democratic. In other words, Democratic leaning states appear less responsive to declines in the business cycle regarding increases in unemployment internet searches.

3. National Survey on Public Opinion about Climate Change

We obtained data from two surveys conducted by the Yale Project on Climate Change Communication that were designed to gauge public opinion about global warming and related topics. The surveys were administered by Knowledge Networks and were conducted between (1) October 8–14, 2008 and (2) December 24, 2009–January 3, 2010. The nationally representative sample sizes for the two surveys are, respectively, 2,189 and 1,001 adults over the age of 18. The two samples are independent so that no respondents are represented in both surveys.[9]

Our empirical strategy takes advantage of five different questions that were asked in both waves of the survey. The questions are reproduced here verbatim, along with the response categories for each:

(1) *Do you think global warming is happening?* 0 = don't know, 1 = no, 2 = yes.
(2) *How sure are you that global warming is happening?* [Asked only if response to the previous question is "yes"] 1 = not sure at all, 2 = somewhat sure, 3 = very sure, 4 = extremely sure.
(3) *How big of an effort should the United States make to reduce global warming?* 1 = no effort, 2 = a small scale effort, even if it has small economic costs, 3 = a medium-scale effort, even if it has moderate economic costs, 4 = a large-scale effort, even if it has large economic costs.
(4) *How much do you support or oppose the regulation of carbon dioxide* (*the primary greenhouse gas*) *as a pollutant*? 1 = strongly oppose, 2 = somewhat oppose, 3 = somewhat support, 4 = strongly support.

[9]Details about the surveys and descriptive statistics beyond those reported here are available at http://environment.yale.edu/climate/.

(5) *Do you think the U.S. Congress should be doing more or less to address global warming?* 1 = much less, 2 = less, 3 = currently doing the right amount, 4 = more, 5 = much more.

In order to simplify our analysis and ease interpretation, we convert the response categories for each question into a dichotomous dummy variable.[10] The recoding allows us to create simple measures of who has strong feelings that climate change is taking place and that the U.S. government should be taking stronger steps toward mitigation. In particular, we transform question #1 such that the dummy equals one if the respondent answers "2" and zero otherwise. Questions #2, #3, and #4 are transformed such that the respective dummies equal one if the respondent answers "3" or "4" and zero otherwise. Finally, we transform question #5 such that the dummy equals one if the respondent answers "4" or "5" and zero otherwise.

Table 2 reports summary statistics for the recoded responses. Sixty-seven percent of the respondents think that global warming in happening. Among these respondents, 68 percent are either "very sure" or "extremely sure" that it is happening. Seventy percent of the respondents think the U.S. should make at least a medium-scale effort to address global warming, even if it has moderate economic costs. Even more, 77 percent of the respondents, are at least somewhat supportive of regulating carbon dioxide as a pollutant. Finally, 63 percent of the respondents think that the U.S. Congress is somewhere between doing the right amount and could be doing more to address global warming.

Table 3 reports summary statistics on the respondents themselves pooled from both waves of the survey. We have data on each respondent's household income, gender, age, years of education, whether he/she in unemployed (defined as temporarily laid off or actively looking for work), ethnicity, marital status, and home ownership. We also use the state unemployment rate data (described in the previous section) corresponding

Table 2. Summary statistics of responses to the climate change survey questions.

Variable	Mean	Std. Dev.	Min.	Max.
Global warming is happening	0.668	0.471	0	1
Sure that global warming is happening	0.682	0.466	0	1
United States should make an effort	0.699	0.459	0	1
Support carbon regulation	0.770	0.421	0	1
U.S. Congress should do more	0.625	0.484	0	1

Notes: Observations are weighted according to U.S. Census Bureau parameters to be nationally representative. Codes for response categories to each question are reported in the main text.

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[10]We also conducted analysis that parallel those reported here using the full set of response categories. Overall, the qualitative results change little, but interpretation is less straightforward.

Table 3. Summary statistics of socio-demographic variables for climate change survey analysis.

Variable	Mean	Std. Dev.	Min.	Max.
Income ($10,000s)	5.951	4.287	0.25	18.75
Male (1 = yes)	0.483	0.500	0	1
Age	46.282	16.849	18	94
Education (years)	13.382	2.728	0	21
Unemployed (1 = yes)	0.075	0.264	0	1
Household size	2.611	1.497	1	15
Race other (1 = yes)	0.065	0.246	0	1
Hispanic (1 = yes)	0.047	0.212	0	1
Black (1 = yes)	0.112	0.316	0	1
White (1 = yes)	0.692	0.462	0	1
Married (1 = yes)	0.502	0.500	0	1
Own home (1 = yes)	0.727	0.446	0	1
Unemployment_rate (state)	7.421	2.181	3.2	14.5

Notes: Observations are weighted according to U.S. Census Bureau parameters to be nationally representative. Statistics are based on 3,185 observations. Unemployed is for respondents that have been temporarily laid off or are actively looking for a job.

with each respondent's state of residence and the month when the survey was administered. While the average statewide unemployment rate among respondents at the time they were surveyed is 7.4 percent, it is worth noting that the rate increased from 6.3 to 9.9 percent between the 2008 and 2009–10 waves of the survey.

We begin by looking at how respondent characteristics affect responses to the survey questions on opinions about climate change. We estimate linear probability models of the form

$$Y_i = \alpha + \beta X_i + \gamma Year\ 2009_i + \varepsilon_i, \tag{3}$$

where i indexes respondents, Y_i is the response variable for one of the survey questions, X_i is the vector of the socio-demographic variables, *Year 2009* is a dummy variable for the second wave of the survey, and ε_i is a normally distributed error term.

Table 4 reports the results of specification (3) for all five of the survey questions. Several results are robust across more than one of the questions. In four out of the five questions, men demonstrate less concern about climate change than women. Not only are they five percent less likely to believe that global warming is happening, they are, for example, 8.6 percentage points less likely than women to say that the United States should make a greater effort to reduce global warming. More education makes respondents more likely to think that global warming is happening, to think it with more certainty, and to believe Congress should be doing more to address the problem. Among the ethnicity results, the comparison between blacks and Hispanics (the omitted category) is the most noteworthy. Looking across the questions, the results

Table 4. Linear probability models of climate change concern.

	(1)	(2)	(3)	(4)	(5)
	Global warming is happening	Sure that global warming is happening	United States should make an effort	Support carbon regulation	U.S. Congress should do more
Income	0.003	0.004	0.000	0.006***	−0.002
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Male	−0.050***	0.004	−0.086***	−0.082***	−0.065***
	(0.017)	(0.020)	(0.016)	(0.015)	(0.017)
Age	0.001	0.001	0.001	0.002***	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Education	0.017***	0.010**	0.000	0.001	0.015***
	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)
Unemployed	0.032	0.036	0.006	0.083***	0.014
	(0.033)	(0.040)	(0.032)	(0.030)	(0.034)
Household size	−0.002	−0.009	−0.012*	−0.004	−0.003
	(0.007)	(0.008)	(0.007)	(0.006)	(0.007)
Race other	−0.012	−0.004	0.040	−0.020	0.025
	(0.041)	(0.048)	(0.040)	(0.037)	(0.043)
Black	−0.075**	−0.089**	0.097***	0.072**	0.078**
	(0.034)	(0.041)	(0.034)	(0.032)	(0.036)
White	−0.103***	−0.049	−0.038	−0.026	−0.051*
	(0.027)	(0.032)	(0.026)	(0.025)	(0.028)
Married	−0.101***	0.018	−0.054***	−0.071***	−0.045**
	(0.018)	(0.022)	(0.018)	(0.017)	(0.019)
Own home	−0.007	−0.095***	−0.039*	−0.042**	−0.026
	(0.020)	(0.025)	(0.020)	(0.019)	(0.021)
Year 2009	−0.131***	−0.133***	−0.127***	−0.085***	−0.135***
	(0.018)	(0.023)	(0.017)	(0.016)	(0.019)
Constant	0.577***	0.642***	0.837***	0.754***	0.524***
	(0.063)	(0.080)	(0.063)	(0.058)	(0.066)
Observations	3,149	2,075	3,087	3,052	3,078
R-squared	0.047	0.032	0.049	0.044	0.043

Notes: Codes for response categories to each question are reported in the main text. Observations are weighted for sample representativeness. *Hispanic*'s in the omitted ethnicity category. The number of observations in each model differs because of missing data, with the exception of model (2), which only received answers if the question in model (1) received a yes response. Three, two, and one asterisk(s) indicate statistical significance at the 99-, 95- and 90-percent levels, respectively.

suggest that blacks are less likely to believe that global warming is a problem, but more likely to think that something should be done about it. What is more, when compared to whites, blacks are also more likely to think something should be done to address climate change. Interestingly, individuals who are married and own their home demonstrate less concern about climate change. For example, married individuals are ten percentage points less likely to think that it is happening, and home owners are 4.2 percentage point less likely to support regulating carbon dioxide as a pollutant.

While a respondent's status as unemployed is insignificant in four out of five questions, the result is somewhat surprising for whether he/she supports regulating carbon dioxide as a pollutant. We find that the unemployed are 8.3 percentage points more likely to support such regulation. One possible explanation is that the unemployed may believe that regulating carbon dioxide will stimulate "green jobs," as politicians often claim. More general macro-economic conditions are being absorbed with the *Year 2009* dummy variable, which captures the average difference in responses between waves of the survey after controlling for the respondent characteristics. In all cases, there is a negative and statistically significant effect, indicating a general decrease in concern about climate change during the time of recession. In particular, relative to similar individuals surveyed in the first wave, those who are surveyed in the second wave are more than ten percentage points less likely to believe that global warming is happening or to support more aggressive mitigation policies.

Our next set of models seek to explore further the effect of changes in the economy during the time of recession between waves of the survey. Specifically, we estimate models of the form

$$Y_{ij} = \alpha + \beta X_i + \gamma Unemployment\_rate_{ij} + \nu_j + \varepsilon_{ij}, \tag{4}$$

where differences from the previous specification are that j indexes states, ν_j is a state-specific intercept, and we include a variable for the state-level unemployment rate corresponding with each respondent at the time he/she was surveyed. Note that by dropping the *Year 2009* dummy, and including state fixed effects and the state's unemployment rate, we are relying on within state variation to determine how the right-hand side variables correlate with the survey measures of concern about climate change. Technically, this possible because there are two waves of the survey. The coefficient of primary interest is γ, as it provides an estimate of how changes in the unemployment rate affects survey responses, controlling for unobserved and time invariant state-level effects. The βs estimate how changes in the socio-demographic variables affect responses, also based on variation within each state. For all models we report the standard fixed effects estimates of a linear probability model with standard errors clustered at the state level.[11]

Table 5 reports the results of all five models. Across them all, we find consistent evidence that respondents who live in states that have experienced increased unemployment are less likely to believe that global warming is occurring or to support regulation to address the issue. A one percentage point increase in the unemployment rate is associated with a 3.3 percentage point decrease in the probability that a respondent thinks global warming is happening. In states where unemployment is rising, respondents also think the U.S. should be making less of an effort to reduce global warming, are less

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[11]We also estimated models, in parallel with the previous section, in which we included the variable *Kerry* interacted with the state's unemployment rate. In four out of the five models, the coefficient on the interaction variable is statistically insignificant. The only exception is the model in column (1), in which case the interaction term has a negative coefficient and renders the coefficient on unemployment statistically insignificant. We thus report the more straightforward specifications in Table 5.

Table 5. Linear probability models of climate change concern with state fixed effects.

	(1)	(2)	(3)	(4)	(5)
	Global warming is happening	Sure that global warming is happening	United States should make an effort	Support carbon regulation	U.S. Congress should do more
Unemployment_rate	−0.033***	−0.033***	−0.031***	−0.023***	−0.034***
	(0.005)	(0.006)	(0.005)	(0.003)	(0.006)
Income	0.002	0.002	0.000	0.005*	−0.003
	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)
Male	−0.050**	−0.003	−0.090***	−0.083***	−0.066***
	(0.020)	(0.026)	(0.024)	(0.021)	(0.022)
Age	0.001	0.001	0.001	0.002***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Education	0.019***	0.011*	0.001	0.002	0.016***
	(0.005)	(0.006)	(0.004)	(0.004)	(0.005)
Unemployed	0.025	0.02	0.010	0.084**	0.015
	(0.050)	(0.063)	(0.048)	(0.040)	(0.049)
Household size	−0.001	−0.010	−0.013	−0.005	−0.004
	(0.008)	(0.010)	(0.010)	(0.008)	(0.009)
Race other	−0.019	0.012	0.028	−0.030	−0.01
	(0.056)	(0.057)	(0.072)	(0.059)	(0.048)
Black	−0.050	−0.081	0.098*	0.080**	0.070
	(0.051)	(0.082)	(0.052)	(0.039)	(0.058)
White	−0.08	−0.041	−0.048	−0.023	−0.080**
	(0.054)	(0.051)	(0.051)	(0.044)	(0.039)
Married	−0.093***	0.021	−0.046*	−0.066***	−0.034
	(0.024)	(0.028)	(0.025)	(0.020)	(0.027)
Own home	−0.003	−0.088**	−0.043	−0.047**	−0.020
	(0.029)	(0.036)	(0.031)	(0.023)	(0.025)
Constant	0.746***	0.843***	1.040***	0.895***	0.740***
	(0.095)	(0.109)	(0.087)	(0.077)	(0.079)
State dummies	Yes	Yes	Yes	Yes	Yes
Observations	3,137	2,068	3,076	3,041	3,067
R-squared	0.073	0.07	0.081	0.074	0.075

Notes: Codes for response categories to each question are reported in the main text. Observations are weighted for sample representativeness. *Hispanic* is in the omitted ethnicity category. The number of observations in each model differs because of missing data, with the exception of model (2), which only received answers if the question in model (1) received a yes response. Three, two, and one asterisk(s) indicate statistical significance at the 99-, 95- and 90-percent levels, respectively.

supportive of regulating carbon dioxide as a pollutant, and think Congress should be doing less to address global warming. When accounting for the state fixed effects, the socio-demographic results for gender, education, marital status, and home ownership are also reasonably robust with respect to statistical significance.

4. Discussion and Conclusion

This paper uses two different sources of data to investigate the association between the business cycle — measured with unemployment rates — and public concern about climate change. Building on recent research that finds internet search terms to be useful predictors of health epidemics and economic activity, we study the relationship between Google keyword searches within a state and a state's unemployment rate. We find, on average, that an increase in a state's unemployment rate decreases searches for "global warming" and increase searches for "unemployment." We also find that in more Democratic leaning states, the decline in global-warming searches is larger, but the increase in unemployment searches is smaller.

While the Google analysis provides evidence based on a revealed preference related to concern about climate change, our other evidence is based on stated preferences that ask about environmental concern directly. We take advantage of two waves of a national survey with common questions about climate change to investigate how responses differ within states based on changes in the states' unemployment rate. We find that an increase in a state's unemployment rate is associated with a decrease the probability that residents think global warming is happening, and with a reduction in the certainty of those who think it is. Higher unemployment rates are also associated with views that we should do less with respect to policies designed to reduce global warming.

Together, the results presented here provide the first empirical estimates of how unemployment rates affect concern about climate change. But what mechanisms are likely to underlie the results? During a recession, households are likely to focus on day-to-day well being rather than more abstract, long term, and uncertain threats such as global warming. The fear of losing one's job, along with concern for friends and family in their efforts to remain employed, are likely to focus attention on the short-run
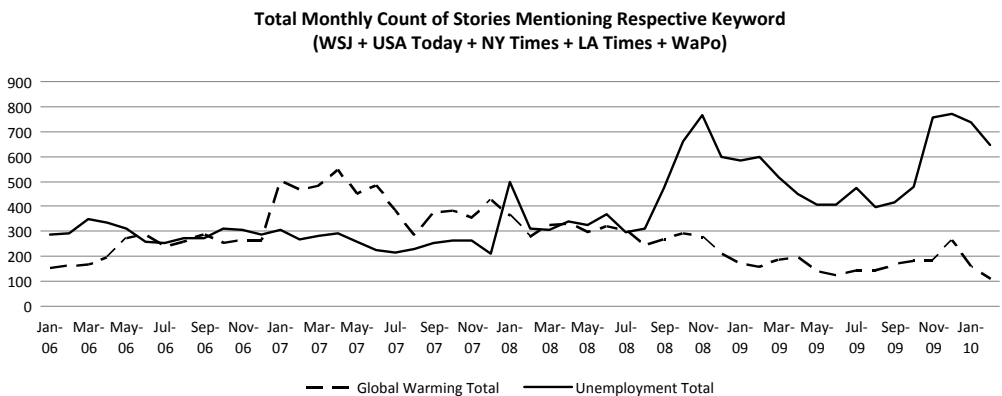
Total Monthly Count of Stories Mentioning Respective Keyword (WSJ + USA Today + NY Times + LA Times + WaPo)

Figure 2. Print media coverage of "global warming" and "unemployment." Data collected using keyword searches in Google news (http://news.google.com/nwshp?hl= en&tab=wn) and summing the number of stories listed by month in the five major newspapers with national coverage.

health of the economy and coping with macro uncertainty. Such behavior is consistent with psychological theory based on Maslow (1943) hierarchy of needs.

Anticipating such shifts in focus, the national media has an incentive to increase coverage of the recession and decrease coverage of environmental issues such as climate change. Based on additional data that we collected from Google News and the Vanderbilt Television News Archive, Figs. 1 and 2 show trends in actual coverage of global warming and unemployment by the national media between January 2006 and January 2010. Figure 1 shows a downward trend in the number of print media stories about global warming in major national newspapers since the beginning of 2007. At the same time, the number of print media stories about unemployment exhibits an upward trend. Figure 2 reports television media coverage in terms of minutes of coverage by month. Note that prior to November 2007, global warming and unemployment receive a similar number of minutes, but thereafter coverage of global warming drops off (with the exception of the spike at the end of 2009 corresponding with the COP 15 meetings in Copenhagen). Meanwhile, coverage of unemployment is substantially higher, especially beginning in the Fall of 2008 when the recession started to take hold.

We must recognize, however, that while media coverage reflects the population's priorities at a given point in time, it also influences peoples' priorities through the spread of information. This is important in the context of recent studies that emphasize the causal role of the media in determining economic and political outcomes (Besley and Burgess, 2002; DellaVigna and Kaplan, 2007; Eisensee and Stromberg, 2007). Accordingly, future research that further investigates the causal relationship between media coverage and environmental concern would be useful. Note that the pattern between internet searches in Figure 1 closely mirrors that in Figs. 2 and 3. Perhaps linking media coverage with internet search activity is one direction for future research about how the media affects public opinion and awareness.
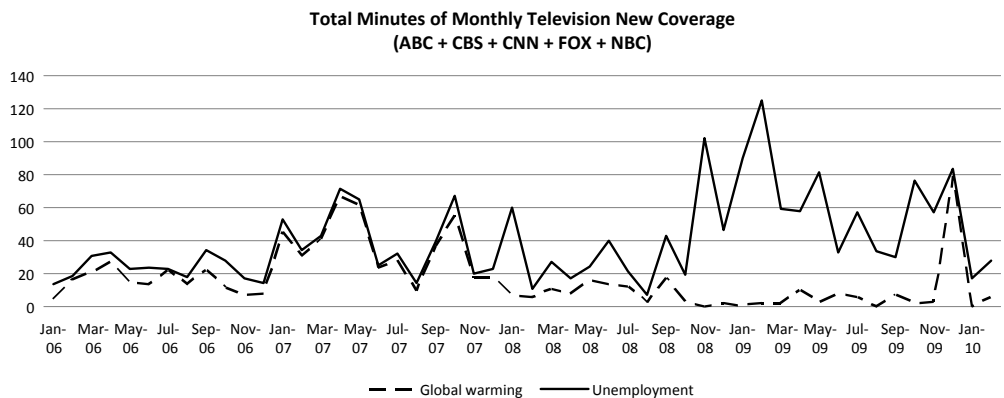

Figure 3. Television coverage of "global warming" and "unemployment." Data collected using keyword searches in the Vanderbilt Television News Archive (http://tvnews.vanderbilt.edu/) and summing the number of coverage minutes by month for all five national networks.

Social interactions are also likely to play a role. It is easy to imagine multiple equilibria, whereby a population can become highly concerned about global warming and interaction with like minded friends and colleagues reinforces this world view. Cultural events, such as watching *An Inconvenient Truth*, may help such individuals connect in residential communities and/or on the internet. Participating in "green consumer" markets with purchases such as a Prius hybrid car, solar panels, or green power may reinforce interest and community discussion of environmental issues (Kahn, 2007; Kotchen and Moore, 2007, 2008). But, of course, the same phenomena can also operate in ways that diminish concern about the environment. A modification of Becker's (1991) bandwagon model offers one possible modeling strategy; for example, one's interest in global warming may decline if his or her peer group's interest declines. From an empirical perspective, a recession may thus represent an exogenous shock that ultimately reduces concern through both individual and peer-group effects. Future research that builds on these ideas would be of value.

Finally, we conclude with emphasis on why understanding the relationship between concern about climate change and recessions is important for public policy and economics. Political scientists argue that economic conditions exert a strong influence on public opinion about regulation, because more expensive regulatory efforts are considered more feasible during good times (Vogel, 1989). A more nuanced argument is that favorable economic conditions promote support for more liberal policies, whereas tougher economic conditions promote support for more conservative policies (Durr, 1993).

It is well-known that public opinion affects which policies ultimately pass and how they are funded and implemented (Page and Shapiro, 1983; Burnstein, 2003). With this in mind, the results of this paper suggest that effective environmental policy in general and climate-change policy in particular is more likely during economic booms. At present, however, we face significant economic challenges concurrent with increasing pressure for substantive climate and energy policies at the state, national, and international levels. Making the connection between the business cycle and environmental concern is an important link in the process of understanding how recessions influence policy-making in general, and for climate change in particular.

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