The Carbon-Climate Cleavage: The Dual Economy, Climate Change, and the Polarization of American Politics

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April 13, 2023

Abstract

The intersection between the climate crisis and America's dual economy contributes powerfully to contemporary political polarization. The dual economy features carbon-intensive industries in the interior and knowledge-intensive industries along the coasts. This new economic geography intersects with exposure to climate-related severe weather; carbon economy communities are insulated from the climate crisis, while knowledge economy communities are directly exposed. This interaction between the dual economy and the climate crisis has generated a new axis of political conflict centered upon the role fossil fuels will play in America's future. Climate change policy has become a focal point of this conflict. Using data on economic geography, political attitudes on climate change policy, and support for Trump in the 2016 and 2020 presidential elections, I describe the dual economy and climate crisis intersection and its association with attitudes towards climate change policy and support for Trump in 2016 and 2020. The analysis indicates that residents of carbon economy communities oppose climate change policy and support Trump, while knowledge economy residents support climate change policy and oppose Trump.

1 Introduction

The US Congress passed the most significant response to the climate crisis in U.S. history, the Inflation Reduction Act (IRA), in August of 2022. Rather than constituting a dramatic shift in American climate change policy, however, the IRA illustrates the extent to which climate change remains a contentious and polarizing issue in American politics. While the IRA allocates $369 billion to subsidies and tax breaks that encourage green energy, it simultaneously "paves the way for a massive expansion of oil and gas drilling on federal lands and in federal waters" (Hemel 2022). Moreover, the Act's promised emissions reductions, 40 percent below their 2005 peak by 2030, are actually quite small. Emissions would likely have been 30 percent below 2005 levels even without the IRA, and America is obligated under the Paris Agreement to reduce emissions by 50 percent by 2030. Thus, the IRA is only a slight improvement over the status quo, and is insufficient to meet global targets. And yet even this rather modest bill could barely muster a Senate majority, as Vice President Kamala Harris had to cast the deciding vote. This indicates that, despite its enormous significance and profoundly consequences, America's climate policy remains deeply controversial and strongly vulnerable to the smallest change in the composition of the US government.

The eighteen-month struggle over climate change legislation (the IRA followed the Biden administration's unsuccessful Build Back Better initiative launched in March 2021) highlights two important and much broader questions about U.S. climate change politics that I address in this paper. First, what is the underlying reason for the political division over climate change policy? Is it a partisan divide reinforced by interest group politics and industry lobbying as most coverage suggests, or does the congressional divide represent a deeper socioeconomic cleavage in the American electorate? Second, how is the division over climate change policy related to the broader polarization of contemporary American politics? Are they two entirely separate phenomena, does one cause the other, or do they stem from a common root? I answer these questions using a dual economy model of contemporary American politics.

Over the last thirty years the U.S. has developed into a dual economy. Throughout most of the twentieth century, the U.S. had a unitary industrial structure organized around fossil fuel-intensive manufacturing such as motor vehicles, steel, petrochemicals, and the machines and equipment needed to produce these consumer durables. It is hard to over-estimate the extent to which these industries dominated the American economy. Auto production alone accounted, directly and indirectly, for one of every six jobs (Lanzilotti 1971, 256; US Department of Transportation 1981). This carbon economy emerged in the first decades of the last century and reached full bloom in the mid-1970s. Over the ensuing decades, however, it has gradually but steadily given way to a dual economy in which one sphere is occupied by the remnants of the carbon economy, while the other is dominated by a knowledge economy organized around information technology, pharmaceuticals, financial services, and a large set of creative and intellectual property intensive industries.

This dual economy sharply divides American society. Residents of the two spheres have different skill sets, work in different industries, live in different regions of the country, and have different experiences. Residents of knowledge economy communities are generally prosperous and highly educated. Palo Alto, California is a typical example. Median household income is $158,000, 83 percent of residents have a four-year college degree, and only 6.1 percent of the population falls below the poverty line. Residents of carbon economy communities, in contrast, usually have less formal education and lower incomes. Peoria, Illinois, a relatively successful carbon economy community, has a median household income one-third of Palo Alto's ($52,000). Only one-third of Peoria's residents hold a four-year college degree and the poverty rate is three times higher (20 percent) than it is in Palo Alto.[1] These spheres constitute the two worlds of contemporary American capitalism.

Knowledge and carbon economy communities have quite different exposures to the climate crisis. It is well known that the specific impacts of climate change vary across space. Some communities are vulnerable to rising sea levels, severe storms, droughts, and wildfires that destroy property and reduce local asset values (what Colgan et al (2021) call climate vulnerable assets). Residents in other communities are exposed to different climate impacts, such as heatwaves and increased rainfall, that are less likely to manifest as catastrophic and economically devastating events. In the contemporary U.S., different exposures to the climate crisis track the dual economy divide. America's knowledge economy communities are located in regions vulnerable to potentially devastating climate change impacts while most carbon economy communities are located in parts of the nation that face much lower and more readily managed risks.

Knowledge economy and carbon economy communities thus have diametrically opposed interests over climate change policy. Climate change constitutes an existential threat for many and indeed most knowledge economy communities. In northern California, for instance, San Francisco Bay poses an "increasingly serious threat to millions of residents and hundreds of billions of dollars of bay front property — from neighborhoods to freeways to airports — as seas continue their slow but relentless rise" (Rogers 2022). Other climate-related threats are present. The Camp Wildfire of 2018 killed 85 people, displaced fifty thousand, and burned 11,000 structures in Paradise, California. The 2020 wildfire season consumed 7.3 million acres along the Pacific coast (Siegler 2019; National Interagency Fire Center 2022). In 2012, Hurricane Sandy damaged 69,000 residential units, killed 43 people, and caused more than $19 billion in damage in the greater New York City area (New York City 2022). Knowledge economy communities thus want ef-

[1] Lest we assume housing costs soak up the difference, median rent in Peoria is 18.6 percent of median income, while in Palo Alto it reaches 19.4 percent of median income. From US Census data https://www.census.gov/quickfacts/fact/table/peoriacityillinois,paloaltocitycalifornia,US/PST045219

fective climate change policy and a rapid phasing out of carbon-intensive industries.

For most carbon economy communities, in contrast, decarbonization poses a much greater threat than climate change. The closure of two coal-fired power plants in Adams County Ohio on the same day in 2018, for instance, eliminated millions of dollars in salaries and tax revenue and forced the county commission to slash spending (Dennis and Mufson 2019).West Virginia Treasurer Riley Moore recently noted that "we're an energy state and energy accounts for hundreds of millions of dollars of tax revenue...All of our jobs come from coal and gas. I mean, this is who we are. This is part of our way of life here in the state. And they're telling us that these industries are bad. We have an existential threat here. We have to fight back" (Gelles and Tabuchi 2022). Carbon economy communities thus have an interest in preserving carbon-intensive industries. Doing so entails resisting comprehensive climate change policy that would encourage the decline of carbon-intensive industries (Gaikwad et al 2022; Bechtel et al 2019; Arndt et al 2022). The intersection of the dual economy and climate crisis exposures has given rise to a carbon-climate cleavage in American politics. The division evident in the IRA and in U.S. climate change politics more broadly is a consequence of this cleavage.

This carbon-climate cleavage also contributes to the broader polarization of contemporary American politics. The dual economy captures the current division between the winners and losers of the ongoing structural transformation of the American economy. Existing scholarship attributes this transformation to trade and globalization (Autor et al. 2017; Autor, Dorn, and Hanson 2016; Broz, Frieden, and Weymouth 2021; Colantone and Stanig 2018; Jensen, Quinn, and Weymouth 2017; Baccini and Weymouth 2021). Even more importantly, the dual economy overlaps with the sociocultural factors, "most notably rising immigration, the decline of traditional values, and the mobilization of women and minority groups" (Berman 2021, 75), that a large body of research sees at the center of right wing populism (see e.g., Abramowitz and McCoy 2019; Abramowitz and Saunders 2008; Bartels 2020; Mutz 2018; Newman, Shah, and Collingwood 2018;

Nivola and Brady 2008; Reny, Collingwood, and Valenzuela 2019; Sides, Tesler, and Vavreck 2019). This overlap can be made clear by contextualizing Mutz's (2018) status threat hypothesis, which posits that right wing populism is a defensive reaction by the historically dominant group in American society, white males with limited educational attainment. White males with no college education are most likely to be (or have been) displaced by the transition away from carbon-intensive production and are least able to transition into the knowledge economy. Climate change further politicizes the dual economy by giving rise to public discussion about and considerable political pressure for government policies that are intended to accelerate the transition away from carbon-intensive industries. Thus, the dual economy and the sociocultural divide are mutually reinforcing. Climate change intensifies the conflict by creating an urgent justification to use government to encourage the transition.

This paper develops the theoretical and empirical foundations of the carbon-climate cleavage. I characterize the theoretical logic of the dual economy, briefly outline climate change impacts, and discuss how these impacts vary across space. I then bring these two dimensions together to identify four ideal typical communities: high climate vulnerable knowledge economy communities, high climate vulnerable carbon economy communities, low climate vulnerable knowledge economy communities, and low climate vulnerable carbon economy communities. I hypothesize that a carbon-climate cleavage exists when society is divided into high vulnerability knowledge economy communities on the one hand and low vulnerability carbon economy communities on the other.

I then evaluate empirically the degree to which the US confronts a carbon-climate cleavage and the extent to which such a cleavage has political significance. To identify the existence of a cleavage I measure and correlate characteristics of dual economy communities and climate vulnerability. The exercise demonstrate that a carbon-climate cleavage does in fact exist–much of American society is organized into mutually exclusive high vulnerability knowledge economy communities and low vulnerability carbon economy communities. To assess whether this cleavage has political significance I present statistical models attitudes towards climate change policy and voter support for Trump. I find that attitudes and support vary systematically across the cleavage in ways I expect. Carbon economy communities with low climate vulnerability oppose climate change policy and support Trump while knowledge economy communities with high climate vulnerability support climate change policy and oppose Trump. The final section summarizes the results and highlights possible avenues for additional research.

2 Theory: The Carbon-Climate Cleavage

A carbon-climate cleavage is a consequence of the degree of overlap between two societal divisions. First, communities rely on different economic growth models. A growth model captures "the relative contribution of the different components of aggregate demand–consumption, investment, government spending, and net exports–to overall economic growth" (Hope and Soskice 2016, 210; see also Baccaro and Pontusson 2016; Hope and Soskice 2016; Blyth and Matthijs 2017; Blyth and Schwartz 2021). A large number of communities continue to rely on the fossil fuel intensive growth model that dominated the industrial economy of the early postwar era. In contrast, many other communities rely on a human capital and intellectual property intensive growth model that has emerged during the last thirty years. These different models rely on different inputs, employ very different production functions, and produce quite different types of good. They thus have very different interests over a range of policies. Second, communities have different exposures to the climate crisis. Some are highly vulnerable to the natural disasters and severe weather events caused by climate change, while others are more insulated from these events. A political cleavage exists, and conflict arises, when these two divisions overlap. When the overlap is high, the policies that satisfy one side, such as phase out carbon-intensive industries to mitigate the climate crisis and protect knowledge economy communities, pose an existential threat to the other. I develop this perspective here, looking first at the logic of a contemporary dual economy, turning then to climate change vulnerabilities, and finally bringing the two dimensions together to describe the conditions for a carbon-climate cleavage.

2.1 The Dual Economy

The dual economy model provides a useful framework for theorizing broad socioeconomic divisions that do not rest entirely on class (or factors of production). Sir W. Arthur Lewis (Lewis 1954) developed the concept of a dual economy in the early 1950s as a model of a "typical" developing country that was structured around a small high productivity modern manufacturing sector and a large traditional low productivity sector, typically agriculture. Economic growth was driven by increased demand for the manufactured goods produced by the high productivity sector. Lewis argued that the traditional sector held surplus labor which transitioned from agriculture to manufacturing. As workers relocated in this fashion, productivity (output per worker) and wages rose in both sectors. The decline of surplus labor in agriculture meant rising output per capita in that sector, and the higher productivity of manufacturing supported higher incomes there as well. Thus, the low-income agrarian society transitioned to a high-income manufacturing economy that supported high incomes in farming as well.

Economic historian Peter Temin (2017) recently modified the standard Lewis model and applied it to the contemporary U.S. Temin defined the high productivity sector in the American economy as finance, technology, and electronics (FTE), or what I call the knowledge economy. These industries rely heavily on human capital and intangible assets rather than physical capital and often consume lots of electricity. However, this electricity can be supplied by solar, wind, and hydro, and need not be tied to fossil fuels. Temin defined the traditional sector as low wage activities outside of the knowledge economy (Temin 2017). This residual definition of the traditional sector is unsatisfactory, however, because it lumps into a single category two quite different economic activities: a variety of capital intensive manufacturing industries on the one hand, and low-wage service industries such as retail, restaurant, and personal services on the other. Because these different economic activities should not be combined into a single sector, I alter Temin's characterization of the traditional sector to one that includes only fossil fuel reliant capital intensive manufacturing and extractive industries. The two spheres of America's dual economy are thus a human capital intensive knowledge economy and a fossil fuel intensive carbon economy. Low wage service industries exist in some form in every community.

Temin introduces a second important revision to the original Lewis model. Lewis assumed that labor was highly mobile across sectors. Workers could readily transition from the traditional to the modern sector because jobs in both sectors required relatively few specialized skills. Temin argues, and correctly so, that labor in the contemporary American economy is relatively immobile between the carbon economy and the knowledge economy (see also Gabe et al. 2018). The ability to move out of the carbon economy and into the knowledge economy typically requires a significant investment in formal education and often even a four-year college degree. Because, as we will see, only a small percentage of the carbon economy workforce holds a college degree, this intersectoral skill differential limits the mobility of the current generation of carbon economy workers into the knowledge economy. Instead, displaced workers in the carbon economy find employment in the low-wage service sector. Limited labor mobility thus causes wages to rise in the knowledge economy relative to the carbon economy and inequality increases. Temin argues, and it is difficult to disagree, that this dual economy dynamic characterizes the trajectory of the American economy since the mid-to-late 1970s.

We might expect community attitudes about a wide range of economic and environmental policies to reflect these different economic structures. Communities embedded in the carbon economy have compelling reasons to offer strong support for policies that either directly sustain fossil fuels or support carbon-intensive industries, such as Federal rules that encourage exploration and drilling on public lands. These communities also would offer little support to policy measures that raise the price of fossil fuels, such as a carbon tax or an emissions trading scheme, and support policy measures that encourage investment in carbon-intensive industries. In contrast, knowledge economy communities, for which fossil fuels in general and carbon-intensive industries in particular are of small and decreasing importance, have few direct economic interests to care about policies that impact fossil fuels and carbon economy. We might thus expect to observe carbon economy communities advocating forcefully for fossil fuel and carbon-intensive industry friendly policies. Knowledge economy communities would object to such policies primarily to advance non-economic goals (e.g., restrict drilling in the Arctic National Wildlife Refuge to limit/prevent damage to the environment).

2.2 Vulnerability to Climate Change

Climate change affects human society via its impact on natural and built environments. Climate change is expected to increase the frequency and severity of extreme weather events. Increased frequency of drought, heat waves, excessive rainfall, hurricanes, and wildfires are a few of the likely consequences. These events will damage property and other assets based in the communities that are exposed to them. Sometimes this damage might manifest as partial or total loss, such as when wildfires consume residential communities. In other instances, asset values might fall because the risk of catastrophic loss is high. The value of beachfront property located on Grand Isle, Louisiana, for instance, might be expected to decline significantly over the next decade. The value of farmland might fall sharply in regions expected to experienced prolonged droughts.

Exposure to these climate impacts varies across space. To take an obvious example, the risk of coastal flooding is highest along the nation's coasts and lowest in its interior. And the severity of the coastal flooding risk among the coastal communities may be higher in some coastal communities than in others. Even within as small an area as New Orleans, for example, vulnerability to flooding varies between the city's center districts, built below sea level, and its uptown area, which stands slightly above sea level. Thus, although climate change is a global phenomenon, its specific impact varies quite significantly across space. Some communities are highly vulnerable to likely impacts, and others considerably less so.

Community-level attitudes toward climate change policy will reflect these different exposures. It is likely that communities for which the risk of climate-related extreme weather events that will deflate local asset prices is high would desire climate change policies that mitigate the crisis. In contrast, it is likely that communities for which the risk of climate-related events that devalue local assets is low would be less likely to prioritize climate change as a concern and be reluctant to support costly measures intended to mitigate the crisis. We might thus expect to observe a high risk vs. low risk division on climate change and emissions reduction policies.

2.3 The Carbon-Climate Cleavage

We can bring the dual economy and climate change exposure together to generate some initial expectations about community attitudes about climate change policy. For ease of exposition, I organize these expectations in a simple two-by-two matrix (see table 1). The columns divide communities by their climate vulnerability and the rows by their location in the dual economy. Each cell represents an ideal typical community's expected orientation toward climate change policy based on its economic and climate impact characteristics.

The northwest cell contains communities characterized by low exposure to cli-

Table 1: The Carbon-Climate Cleavage

	Low Exposure	High Exposure
Carbon Economy (CE)	**Sustain CE & oppose GHG cuts**	Sustain CE & reduce GHGs
Knowledge Economy	Ambivalent How Costly?	**Shrink CE to reduce GHGs**

mate impact and high reliance on carbon-intensive industries. These communities want to sustain the carbon economy and generally oppose greenhouse gas (GHG) emissions cuts. They do so because decarbonization to reduce GHG emissions eliminates jobs in carbon-intensive firms within each community, and also imperils the retail outlets, the real estate markets, and the government services that these jobs support. As employers close and jobs disappear, tax revenues fall, and public services decline in quality. Housing values fall as people leave the community, further depressing tax revenues and forcing additional cuts to public services. Climate change mitigation, in contrast, offers few immediate direct benefits to these communities because assets here are less exposed to catastrophic weather-related events that can be tied directly to climate change. Such apparent insulation from the most catastrophic climate change related weather may be reinforced by motivated reasoning (Hart and Nisbet 2012; Kahan 2015) in conjunction with the "invisibility of climate change and the uncertainty in attributing specific events and weather patterns to the broader phenomenon" (Egan and Mullin 2017, 211). Carbon economy residents don't want to believe in climate change and are thus reluctant to attribute specific weather events (drought, heavy rain, heat waves) to a changing climate, choosing instead to view them as "normal" fluctuations in an otherwise unchanging climate. Carbon economy residents are unlikely to support climate change policy. These communities thus see considerable community-wide asset value depreciation from decarbonization and few direct benefits from climate change mitigation.

Communities in the northeast cell rely heavily on carbon-intensive industries and face high risk from climate impacts. Thus, these communities share with communities that populate the northwest cell an aversion to dramatic shifts away from the carbon economy and for the same reasons. Yet, in contrast to the carbon-intensive and low climate impact exposure communities, this group is vulnerable to climate change. This combination creates a somewhat schizophrenic set of policy positions that advocate a reduction of GHG emissions to minimuze asset depreciation from this risk but also resist decarbonization to minimize asset depreciation from this pathway. Such communities might be strong supporters of carbon capture and sequestration technologies.

The southeast cell contains communities that rely heavily on the knowledge economy and are highly exposed to climate change impacts. These communities are strong advocates for rapid decarbonization in order to reduce GHG emissions. This position reflects the recognition that climate change policies impose few costs and promise significant benefits for these communities. Knowledge economy communities suffer few costs from climate policy because they no longer depend on fossil fuels as a source of electricity or as a core element of the industrial processes that dominate local economic activity. Because knowledge economy communities have such limited direct economic exposure to decarbonization, they have little direct economic incentive to oppose climate change policy. At the same time, these communities realize significant benefits from climate change mitigation policy because they are directly exposed to severe weather events generated by climate change.

Finally, the theory expects communities that fall in the southwest cell to be ambivalent about climate change policy in terms of direct costs and vulnerabilities. Because these communities rely heavily on industries in the knowledge economy, local economic activity will not decline in scale and community-based assets will not fall in value as a consequence of decarbonization. Yet, because these communities have low exposure to the climate crisis, they do not expect asset values to fall due to these changes either. Such communities have little direct incentive to pay significant costs, in form of higher energy prices or rising taxes to subsidize green industrial policy, in order to mitigate emissions. At the same time, they have no strong reason based on the composition of local industry composition to oppose decarbonization.

Whether a carbon-climate cleavage exists depends on how communities are distributed across this two-by-two matrix. A sharp carbon-climate cleavage to exist only if communities are divided into the northwest to southeast cells. With this distribution, one set of communities is a strong voice in favor of decarbonization to mitigate the climate change risk they face while another set is an equally strong force pushing for the continuation of the carbon economy to sustain the dominant industries in their communities. The policy advocated by communities in each cell thus threaten the continued existence of communities located in the other cell. There is little room for compromise. No cleavage exists if communities cluster in a single cell. For example, most American communities in 1968 lay in the northwest cell–heavy reliance on the carbon economy and low exposure to climate related severe weather events. Nor is a sharp cleavage likely to form if communities cluster in the southwest and northeast cells. In this case, communities in the northeast cell want to continue the carbon economy and and also to reduce GHG emissions, and communities in the southwest cell are fine with this approach so long as the reductions do not impose high costs on them. Nor is a sharp cleavage likely if communities are divided between the northeast and the southeast cells. These communities agree on the need to address climate change and might share an interest in developing carbon capture and sequestration technology, one because of their broader interest in intellectual property and innovation, the other because carbon capture solves the paradox they face. Thus, a cleavage exists when the US is divided between knowledge-intensive high vulnerability communities and low vulnerability carbon economy communities.

3 Data and Analysis

I evaluate the theoretical argument in two steps. I first examine whether a carbon-climate cleavage exists using the geography of the American dual economy, the geography of climate impact exposure, and the overlap between them. I then evaluate whether this carbon-climate cleavage has political significance by regressing county-level support for climate policy and for Trump against the measures of the dual economy and climate change vulnerability.

3.1 The Carbon-Climate Cleavage

I first measure and map the dual economy and climate impact vulnerability. I measure a community's location in the the dual economy using four indicators. First, I construct a measure of jobs in carbon-intensive industries as a share of total jobs for each county. I define carbon-intensive industries as oil and gas extraction, coal mining, motor vehicle manufacturing (including agricultural and construction machinery), primary metals manufacturing, and petrochemical manufacturing.[2] I exclude employment in coal-fired (and natural gas fired) electricity generation because available data do not allow me to differentiate between clean and dirty electricity in the utilities sector at the county level. My second indicator is industrial greenhouse gas emissions per capita. I created this measure by summing enterprise level GHG emissions data made available by the Environmental Protection Agency to create county-level total emissions. I then standardized by county population. The measure includes only emissions from industrial processes, and thus excludes GHG emitted by transportation and agriculture. The third measure is labor force skill level, which I construct using the ratio of college graduates to high school graduates. Education is a good proxy for the importance of knowledge-

[2] The industries are oil and gas extraction (NAICS 211), motor vehicle production (NAICS 3361), primary metals (NAICS 331), petrochemical manufacturing (NAICS 3251), agricultural, construction, and mining machinery (NAICS 3331), plastics and rubber manufacturing (NAICS 326) and coal mining (NAICS 212). Data come from US Census Bureau 2019.

intensive industries (Moretti 2013). Higher values indicate a more highly skilled labor force. Finally, I use total patents awarded to county residents–private and commercial–between 2000 and 2015.

I measure climate impact vulnerability with the U.S. Federal Emergency Management Agency (FEMA) National Risk Index (NRI) (FEMA 2022). The NRI evaluates county-level vulnerability to eighteen natural disasters.[3] Risk is estimated as the expected property loss from natural disasters multiplied by social vulnerability and divided by community resilience. FEMA defines social vulnerability as the "susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood." Community resilience in contrast "is the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions." The index is measured at the county level and varies from 0 (extremely low risk) to 100 (very high risk).

Turning first to the dual economy, the maps indicate a clear division based on economic geography. Figure 1 maps carbon-intensive job share. Counties that rely heavily on carbon-intensive jobs cluster in the nation's interior of the country. Carbon-intensive manufacturing and coal mining are concentrated in the Great Lakes region while oil and gas extraction and petrochemical manufacturing are most important along the Gulf Coast and through the Great Plains. And while jobs in these carbon-intensive industries are not absent entirely from counties along the Atlantic and Pacific coastlines, they constitute a much smaller share of employment in these coastal communities than they do in the interior.

[3]The natural disasters are: Avalanche, Coastal Flooding, Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado, Tsunami, Volcanic Activity, Wildfire, and Winter Weather.

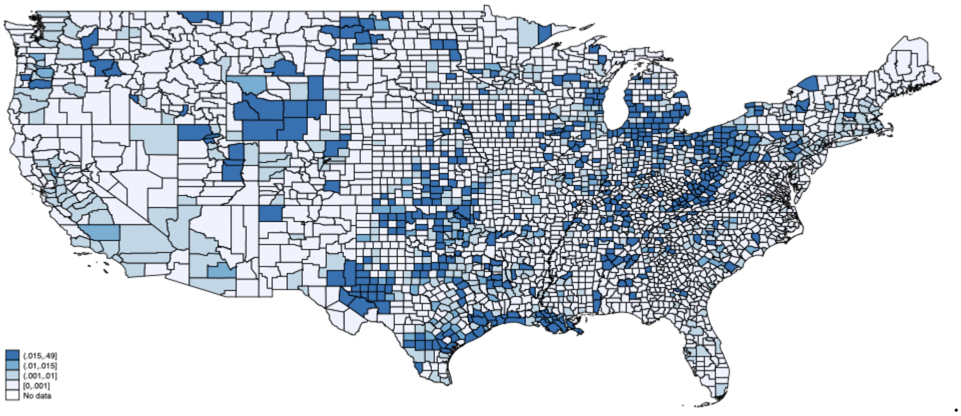

Figure 1: Carbon Intensive Job Share

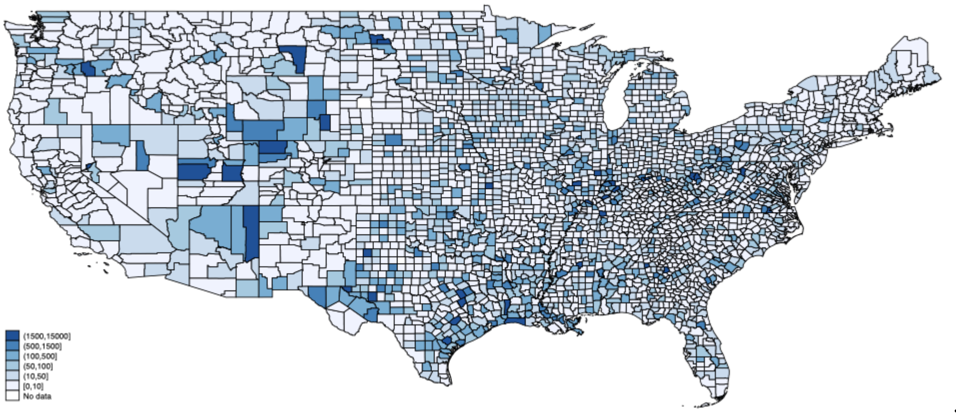

Figure 2: Industrial GHG Emissions

A very similar pattern is evident in the map of industrial GHG emissions (figure 2). Industrial GHG emissions per capita are highest along the Gulf coast and in counties in the nation's interior and they are significantly smaller along the coasts.

The skill level map (figure 3) is a mirror image of these two carbon economy characteristics. For ease of interpretation, I have grouped the values into three buckets: High School Only heavy, an approximate balance between high school and college graduates, and College Graduates heavy. Coastal counties have a higher proportion of skilled workers while the counties in the interior typically have higher proportion of unskilled workers. This pattern is not noticeably different if one instead uses the percent of the population with college degrees or with high school diplomas only in place of the college to high school ratio. Figure 4 indicates that patents are heavily concentrated in the northeast corridor and also in California.

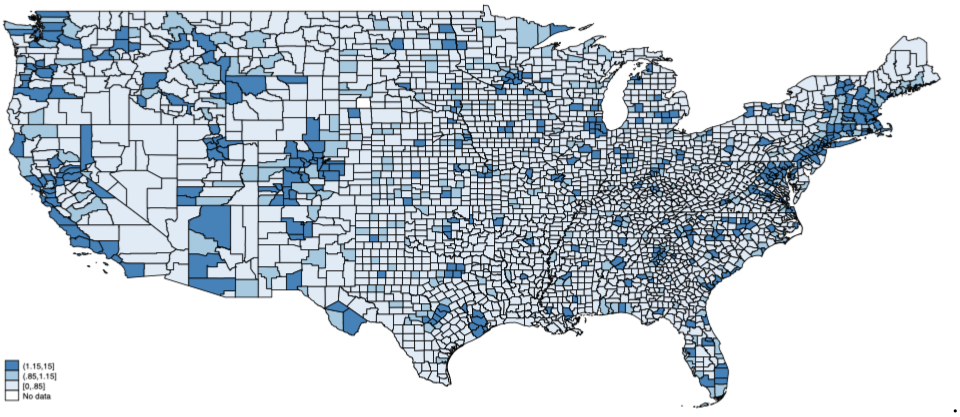

Figure 3: Skill Level of County Labor Force

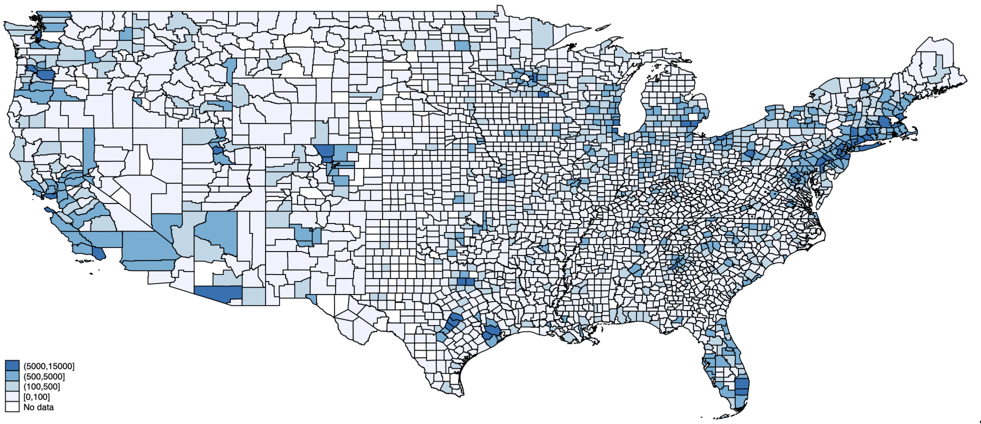

Figure 4: Patents per capita, 2000-15

The dual economy does have a significant geographic structure. On the one hand, most community livelihoods appear to rest on the fortunes of one or the other sector rather than on a diversified selection of industries from both sectors. On the other hand, carbon-economy communities and knowledge-economy communities are located in different regions of the country. The knowledge economy has taken root along the nation's northeast and west coasts, while the carbon economy dominates the nation's interior. One might reasonably suggest that the geography of the dual economy is fairly readily politicized as each sector has a narrow economic interest with few local forces to moderate the position or encourage cooperation.

Turning our attention now to community exposure to climate change impacts, figure 5 maps the National Risk Index. We see the extent to which the risk of climate-change related disasters varies across the US. Areas of Very High and Relatively High risk are concentrated along the Pacific Coast, Florida, and portions of the Atlantic Coast south of New York City. In contrast, FEMA estimates that communities in the nations' interior face relatively low risk, with a few exceptions in large urban centers with high concentrations of vulnerable populations. These data thus illustrate the point that climate vulnerability varies across space and, in the US context, risk is highest along the coasts and lowest in the interior.

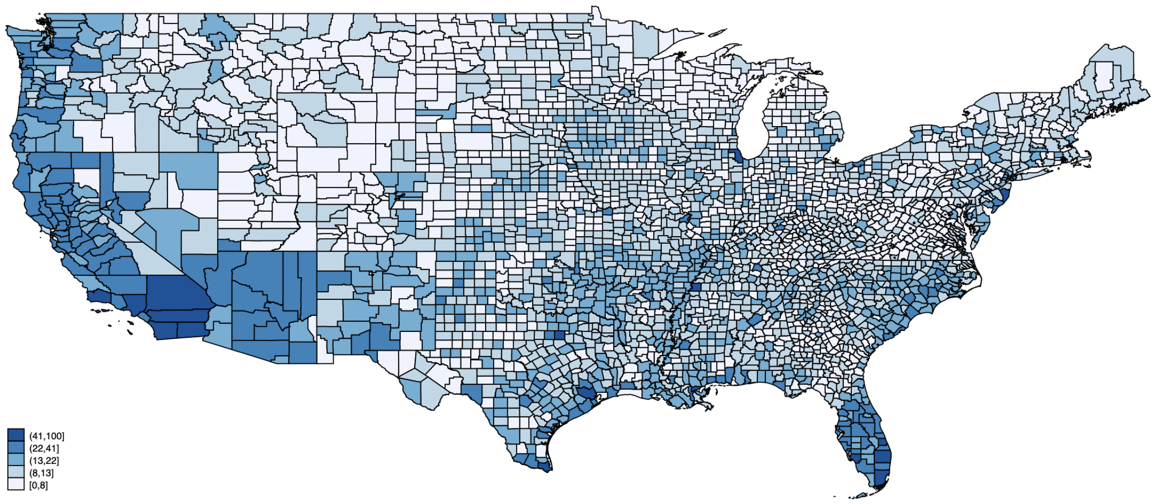

Figure 5: FEMA National Risk Index, 2021

Difference of means tests indicate that the dual economy and exposure to climate change risk overlap to produce a carbon-climate cleavage. To implement these difference

Table 2: Economic Structure in High and Low Climate Vulnerable Counties, Difference of Means Tests

	High Vulnerability	Low Vulnerability	t-stat
Skill Level	.88	.67	7.28
Patents	1628	263	8.48
Carbon-intensive jobs	.01	.02	2.76
GHG Emissions per capita	43.80	105.85	2.66

of means tests I used the NRI to create a dummy variable that takes the value of 1 if the county is rated at relatively moderate risk or greater and takes the value 0 if it is rated as relatively low risk or below. Using this coding rule, counties rated by the NRI at greater than 13.8 on a 0 - 100 scale (every county that is yellow or red shaded in figure 5) were coded 1 for high vulnerability. All tests (Table 2) indicate a statistically significant difference in the economic structure of high and low vulnerability counties. Moreover, the tests reveal that the knowledge economy dominates high vulnerability counties while the carbon economy dominates in low vulnerability counties. In high vulnerability communities the labor force is highly skilled, there are few carbon-intensive jobs account for significantly less employment, and firms produced almost times as many patents as low vulnerability counties. In addition, industries in low vulnerability communities emit twice as much industrial GHGs per capita as the industries present in high vulnerability counties.The difference in GHG emissions increases substantially if we exclude from the sample oil-producing coastal counties in the Gulf of Mexico. With these ten counties omitted, industrial GHG emissions per capita in high vulnerability communities fall to less than one-third of the level of the low vulnerability counties.

We thus see considerable evidence of the carbon-climate cleavage. Knowledge economy communities are highly vulnerable to climate change impacts while carbon economy communities have relatively low vulnerability to climate change impacts. This is the distribution that I associated with the carbon-climate cleavage above. The overlap is not perfect, and we would hardly expect it to be so in a large and complex society such as contemporary America. The Gulf Coast, for instance, occupies the southwest cell of the matrix, as it combines high reliance on carbon-intensive industries and high vulnerability to climate change impact.

3.2 The Political Significance of the Carbon-Climate Cleavage

I evaluate whether the carbon-climate cleavage has political significance for American politics by correlating the attributes of the cleavage with county-level attitudes on climate change policy and support for Donald J. Trump in the 2016 and 2020 presidential elections. I focus on the county rather than the individual because I expect that residents of each sector of the dual economy will hold similar preferences over these issues irrespective of differences in direct ownership of or employment in knowledge or carbon-intensive industries. For instance, the income of a school teacher in a carbon economy community is tied closely to the fortunes of the carbon-intensive industries in their county. We would thus expect the teacher as well as the coal fired plant operator to oppose climate change policy. Individual attitudes will vary around the county's mean, perhaps the teacher is less opposed than the coal plant operator. Yet, I expect the mean level of support for climate change policy to be significantly different in the carbon economy and knowledge economy communities. I look first at county-level support for climate policy and then turn to the 2016 and 2020 presidential elections.

3.2.1 Climate Change Policy Attitudes

Community attitudes toward climate change policy correlate highly with their location in the carbon-climate cleavage. To capture community climate change policy attitudes, I rely on data produced by The Yale Program on Climate Change Communication. These data are estimates of county-level attitudes about climate change policy derived from a statistical model of a national survey data set with more than 25,000 observations (Howe et al. 2015). I analyze public support for two statements about specific climate policy measures and two statements that concern views on broader government efforts. The four statements are:

- We should "regulate carbon dioxide (the primary greenhouse gas) as a pollutant."
- We should "expand offshore drilling for oil and natural gas off the U.S. coast."
- "The President should do more to address global warming."
- "Global warming should be a high priority for the next president and Congress."

Each response is coded as the percentage of the county population that supports the statement. I expect carbon economy communities to oppose regulating carbon dioxide, support offshore drilling, and oppose greater efforts to address climate change. And I expect these positions to be more strongly in low vulnerability carbon economy communities than in high vulnerability communities. In contrast, knowledge economy communities should support carbon dioxide regulation, oppose offshore drilling, and support efforts to do more to address climate change, and these positions should be more pronounced in high vulnerability than in the low vulnerability communities.

Table 3: The Carbon-Climate Cleavage and Support for Climate Policy

	Low Vulnerability	**High Vulnerability**
Carbon Economy		
Limit CO2 Emissions	37 **(58.6)** 78	41 **(61.9)** 81
Drill Offshore	39 **(60.7)** 76	41 **(58.1)** 71
Knowledge Economy		
Limit CO2 Emissions	43 **(66.4)** 81	51 **(69.5)** 85
Drill Offshore	33 **(53.1)** 70	28 **(49.8)** 68

As a first step I look at mean support in each of the four communities for the two climate policy questions. I assigned counties to these categories using the same rule for climate vulnerability as above. For the dual economy I assigned counties knowledge and carbon economy status based on the skill variable and the carbon-intensive jobs variable. I present the mean (in parantheses) and the minimum and maximum for each category. In both instances, we see a large difference in support between carbon economy and knowledge economy communities. As expected, carbon economy communities offer less support for limiting CO_2 emissions and more support for offshore drilling than knowledge economy communities. Also as expected, high vulnerability communities in both sectors offer greater levels of support for climate policy than low vulnerability communities. And finally, the greatest difference in support, almost 11 points for each policy, is the gap that separates low vulnerability carbon economy communities and high vulnerability knowledge economy communities.

Turning now to the multivariate analysis, I employ five measures to capture a county's location in the carbon or knowledge economies. Four are identical to those I introduced above in the discussion of the dual economy: Carbon-intensive Jobs, GHG emissions per capita, Skill Level, and Patents. To these I add Coal-fired Power, which is the amount of electricity, measured in megawatts per capita, generated by coal-fired plants. This is measured at the state rather than the county level. I use the National Risk Index to capture direct exposure to climate change. I use county unemployment rate to capture the economic anxiety hypothesis. Finally, to control for the status threat hypothesis I include Trump's share of the county vote in the 2016 presidential election. This variable controls for attitudes that reflect ideological orientation (conservatives are less likely to support climate change policy) or cue taking behavior in which individuals derive their positions from Trump's position given their support for Trump (i.e., I support Trump because he will "Make America Great Again," and Trump calls climate change a hoax. I thus oppose climate change policy). I estimated all models using Stata's ordinary least squares procedure. The results of the analysis are presented in table 5.

Notice first that all models perform well and report consistent results. As a group,

Table 4: The Carbon-Climate Cleavage and Climate Change Policy

	Limit CO_2	Drill Offshore	Prioritize Climate	Government Effort
Carbon-intensive Jobs	-7.43***	10.70***	-8.17***	-4.37***
	(1.68)	(2.14)	(1.79)	(1.24)
Coal-fired plants	-363.23***	82.67	-399.50***	-168.54***
	(45.48)	(58.10)	(48.49)	(33.51)
GHG Emissions	-0.004***	0.001***	-0.001***	0.000***
	(0.00)	(0.00)	(0.00)	(0.00)
Skill Level	0.80***	-1.98***	0.62***	-0.12
	(0.13)	(0.16)	(0.14)	(0.09)
Patents	-0.000	-0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)
Vulnerability	0.04***	-0.09***	0.15***	0.03***
	(0.01)	(0.01)	(0.01)	(0.01)
Unemployment	-0.24***	0.57***	0.18***	0.07
	(0.05)	(0.06)	(0.05)	(0.04)
Trump Vote 2016	-33.33***	25.29***	-31.70***	-30.62***
	(0.52)	(0.67)	(0.56)	(0.39)
Constant	82.55***	42.61***	61.62***	73.31***
	(0.52)	(0.66)	(0.55)	(0.38)
R-squared	0.77	0.59	0.73	0.80
N	2921	2921	2921	2921

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

they account for between fifty-nine and eighty percent of the total variance, and only one of the estimated coefficients on the variables of interest fails to return a statistically significant coefficient. Moreover, the group of models, as well as each model individually, provide substantial support for the central expectation we derived from the carbon-climate cleavage hypothesis.

The measures of the dual economy yield significant and correctly signed coefficients across the models. Carbon-intensive Jobs conforms to our expectations. The larger the share of carbon-intensive jobs, the less support there is for policies intended to encourage decarbonization and mitigate climate change. And again, the effect's substantive magnitude is large, ranging from a 4-point to a 10-point change in support as we move from minimum exposure (zero jobs) to maximum dependence. GHG Emissions is also significant across three models and carries the expected sign. We see greater opposition to limiting GHG emissions and to making climate change a priority in high emitting counties than in low-emitting counties, while support for offshore drilling is higher in the high emitting counties than in low emitting counties. Coal-fired plants is also significant. As megawatts per capita generated by coal-fired plants increase, support for climate change policy falls. Again, the magnitude of the estimated relationship is substantively large. As we move from counties in states without coal fired plants to counties that are the most dependent on coal-fired plants for their power, the estimated support for limits on coal plants' CO2 emissions falls by about one point. Coal-fired plants does not impact support for Offshore Drilling, perhaps reflecting concern about natural gas as a substitute for coal in electricity generation, but a dummy variable for oil production is positive and significant.

Skill level also tells a consistent story across the models. Counties with a high skilled work force exhibit a higher level of support for climate change policy than do counties with a low skilled work force, although this relationship does not pertain to evaluation of Presidential Effort on climate change. Patents yields mixed results. The measure is not significant in two models, and is significant and carries a negative sign in the other two models. This indicates that counties with a lot of patents oppose the idea that the next government should prioritize climate change and also are not satisfied with the efforts of the current government. These two positions seem somewhat inconsistent and are thus difficult to interpret.

Our measure of vulnerability to climate change impacts returns a significant and correctly signed coefficient in all of the models. Support for strict limits on coal-fired plants' emissions is stronger in high vulnerability counties than in low vulnerability countries, while support for offshore drilling is stronger in low vulnerability counties than it is in high vulnerability counties. In addition, residents of high vulnerability counties exhibit greater support for having the next government prioritize climate change and are more inclined to agree with the statement that the president should make a greater effort to address climate change. We do thus find a positive relationship between a community's direct exposure to some of the negative impacts of climate change and its level of support for climate change mitigation.

Finally, the two control variables yield mixed results. Unemployment is always significant and carries the expected sign in two of the four models. Support for limits on CO_2 weakens while support for Offshore Drilling increases as the unemployment rate increases. Somewhat surprisingly, support for making climate change policy a priority also increases in line with county unemployment. The estimated relationship between unemployment and Presidential effort is smaller and more uncertain. There is thus some indication that the county-level macroeconomic environment shapes support for climate change policy. Finally, Trump 2016 is statistically significant, the estimated effect is quite large, and the coefficients carry the expected sign in all models. This finding tells us that support for climate change policy is lower in counties that supported Trump in the 2016 election than in counties that voted for Hillary Rodham Clinton even after we take into account the dual economy and climate vulnerability factors. Trump counties offer less support for CO_2 limits, more support for offshore drilling, and are less inclined to make climate change policy a near term priority.

Finally, I estimated versions of these same models using the dummy variables derived from the dual economy and climate vulnerability variables (table 5). I omit high vulnerability knowledge economy communities, and thus the estimates for the other three are relative the this excluded category base. We find, as expected, that the low vulnerability knowledge economy communities are less enthusiastic about climate policy than their high vulnerability peers. Low vulnerability carbon economy communities are least supportive of climate policy while their more vulnerable peers generally provide

Table 5: The Carbon-Climate Cleavage and Climate Change Policy

	Limit CO_2	Drill Offshore	Prioritize Climate	Government Effort
Low Vulnerability	-0.517	1.549***	-3.059***	-0.974***
Knowledge Economy	(0.35)	(0.41)	(0.34)	(0.23)
Low Vulnerability	-1.909***	3.688***	-3.292***	-0.656**
Carbon Economy	(0.32)	(0.37)	(0.31)	(0.21)
High Vulnerability	-0.932**	2.694***	-1.193***	-0.472*
Carbon Economy	(0.34)	(0.40)	(0.33)	(0.22)
Rate	-0.402***	0.759***	0.059	0.063
	(0.05)	(0.06)	(0.05)	(0.03)
Trump Vote 2016	-34.621***	27.268***	-33.666***	-30.485***
	(0.52)	(0.61)	(0.51)	(0.35)
Constant	85.638***	35.408***	67.530***	73.931***
	(0.43)	(0.50)	(0.42)	(0.28)
R-squared	0.693	0.546	0.701	0.787
N	3106.000	3106.000	3106.000	3106.000

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

greater support for climate policy initiatives. As with the prior models, these results are robust to the inclusion of the county unemployment rate and Trump's 2016 vote share. Unemployment is significant and signed in the expected direction in the two specific policy models, and Trump 2016 is significant and carries the expected sign across all four models.

Models of climate change policy attitudes thus indicate that the carbon-climate cleavage contributes to political division. The models suggest that high vulnerability knowledge economy communities and low vulnerability carbon economy communities hold opposing views on climate change policy, and suggest further that the views of each are consistent with the expectations developed above. We see also that exposure to climate change affects community support from climate policy, with high vulnerability communities providing greater support for climate policy than low vulnerability communities. Carbon economy communities, which bear costs from decarbonization and perceive themselves insulated from the direct impacts of climate change, oppose climate change policy.

3.2.2 Presidential Elections

I turn now to the 2016 and 2020 presidential elections. I expect Trump to capture a larger share of the vote in low vulnerability carbon economy communities than in high vulnerability knowledge economy communities and Hillary Clinton in 2016 and Joseph Biden in 2020 to attract more support in the high vulnerability knowledge economy communities than in the low vulnerability carbon economy communities.

We look first at average support in each of the four communities (table 6). The pattern conforms to our expectations. Support for Trump was strongest in the low vulnerability carbon economy communities and weakest in the high vulnerability knowledge economy communities. Moreover, in both elections, in the knowledge economy communities, support for Trump was somewhat stronger in low vulnerability communities than in high vulnerability communities while in the carbon economy communities support was greater in high vulnerability areas than in low vulnerability communities. As was the case with support for climate policy measures, the largest difference, one of 25 points in average support, separates the low vulnerability carbon economy communities and the high vulnerability knowledge economy communities. We thus see evidence consistent with the existence of a carbon-climate cleavage in the two most recent presidential elections.

To evaluate these expectations I estimated models of county-level vote shares in the 2016 and 2020 presidential elections. The dependent variable is the share of the popular vote captured by Trump in each election. Model specifications and the specific measures are identical to the climate change models reported above. In addition, I control for each county's Republican orientation using residuals from a model of the prior presidential election. In the 2020 election, Trump '16 is the portion of Trump's 2016 vote share in each county that is not explained by the carbon, climate, and other control variables.

Table 6: The Carbon-Climate Cleavage and Support for Trump

	Low Exposure	High Exposure
Carbon Economy		
2016	11 (68) 94	9 (60) 89
2020	11 (70) 95	14 (62) 92
Knowledge Economy		
2016	13 (50) 95	4 (42) 80
2020	13 (50) 96	12 (42) 80

In the model of the 2016 election, Romney '12 is the portion of Romney's 2012 vote share that is not explained by the carbon, climate, and other control variables. These two measures of Republican orientation capture many of the unobserved factors in each county that shape support for Trump. These factors include partisanship, gender, race, and a bundle of identity-based attitudes toward minorities. The results are presented in table 4.

The models show the same patterns in Trump's vote share in both elections. Specifically, Trump's share of the county vote in both elections increased in line with the importance to the community of carbon-intensive jobs, of coal-fired electricity and of per capita industrial GHG emissions, and fell as a function of skill level and patents. In addition, support for Trump was significantly lower in high vulnerability counties than it was in low vulnerability counties. Notice also that Unemployment is always significant and negative; support for Trump was lower in high unemployment counties than in low unemployment counties. This suggests that local macroeconomic conditions did influence Trump's vote share, but the direction of the effect is opposite to the economic anxiety hypothesis as applied to a populist reaction and more consistent with the long-standing belief and hypothesis that high unemployment favors the Democrat candidate.

The controls for Romney's vote share in 2012 and Trump's vote share in the 2016 elections are significant and carry the expected positive signs. The coefficients reveal,

Table 7: The Carbon-Climate Cleavage and Presidential Elections

	2016	2020
Carbon Job Share	0.13***	0.14***
	(0.02)	(0.02)
Coal-fired Plants	0.11***	0.12***
	(0.004)	(0.00)
GHG Emissions	0.01***	0.02***
	(0.002)	(0.001)
Skill Level	-0.13***	-0.14***
	(0.001)	(0.00)
Patents	-0.00***	-0.00***
	(0.00)	(0.00)
Vulnerability.	-0.003***	-0.001***
	(0.00)	(0.00)
Unemployment	-0.03***	-0.03***
	(0.00)	(0.00)
Republican Share in Prior Election	0.87***	0.96***
	(0.01)	(0.00)
Constant	0.76***	0.77***
	(0.01)	(0.00)
R-squared	0.91	0.96
N	2921	2921

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

unsurprisingly, that higher support for Romney in 2012 predicts higher support for Trump in 2016 and that higher support from Trump in 2016 predicts greater support for Trump in 2020. More importantly for my purposes here, even when we include these controls, thus capturing support for Trump due to factors other than carbon and climate, we find that the carbon-climate cleavage variables continue to return statistically significant and correctly signed coefficients. Support for Trump was strongest in low vulnerability carbon economy communities and weakest in high vulnerability knowledge economy communities. In addition, the fact that carbon, climate, and more sociocultural variables all return significant coefficients suggests that these two factors might be complementary rather than alternative explanations.

As a final step I estimated the models using the community dummy variable cate-

Table 8: The Carbon-Climate Cleavage and Support for Trump

	2016	2020
Low Vulnerabilty	0.01	-0.004
Knowledge Economy	(0.01)	(0.01)
High Vulnerability	0.16***	0.18***
Carbon Economy	(0.01)	(0.01)
Low Vulnerability	0.21***	0.20***
Carbon Economy	(0.01)	(0.01)
Unemployment	-0.02***	-0.02***
	(0.00)	(0.00)
Republican Share in Prior Election	0.85***	0.89***
	(0.01)	(0.01)
Constant	0.56***	0.58***
	(0.01)	(0.01)
R-squared	0.78	0.79
N	2921	2921

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

gories (see table 8). The high vulnerability knowledge economy communities are again the excluded category. The models again conform to our expectations. They indicate no statistically significant increase in Trump's vote share in the low vulnerability knowledge economy communities relative to their high vulnerability peers. And the carbon economy communities offer significantly more support for Trump than the knowledge economy communities. Moreover, as we expect, support for Trump is stronger in the low vulnerability carbon economy communities than it is in the high vulnerability carbon economy communities. The two control variables return the same coefficients as in the fuller specification. Counties that voted heavily for Romney in 2012 and for Trump in 2016 for reasons other than dual economy and climate vulnerability provided stronger support for Trump in 2016 and 2020 than communities who voted in large numbers for the Democrat in the prior elections. Unemployment is significant, though again the coefficient is negative, indicating that county support for Trump decline as county unemployment increased. Overall, these results are consistent with our core expectations.

4 Conclusion

Contemporary polarization of American politics results, in part, from the intersection of the dual economy and the climate crisis. The dual economy divides America into knowledge economy communities and carbon economy communities, with limited labor flows between them. American communities also have different exposures to climate change risk. Some communities are much more exposed to negative climate impacts than others. These two dimensions overlap to a considerable extent. Knowledge economy communities are often highly exposed to climate change impacts, and many carbon economy communities have low exposure to these impacts. This overlap gives rise to the carbon-climate cleavage.

The carbon-climate divide pits the two communities against each other over climate policy. Policy measures required to safeguard knowledge economy communities from climate change impacts, almost all of which encourage a reduction of fossil fuel consumption, necessarily pose a threat to the carbon-intensive industries that upon which carbon economy communities depend. At the same time, failing to implement policies to address climate change in order to sustain the carbon economy allow the climate crisis to worsen and thereby imperils knowledge economy communities. We thus expect high vulnerability knowledge economy communities and the low vulnerability carbon economy communities to hold sharply opposed preferences on climate change policy and to vote for pro and anti climate change candidates in presidential elections.

The empirical analysis presented here is consistent with these expectations. High vulnerability knowledge economy communities tended to exhibit the strongest support for climate policy, both in the individual policy measures and in the general importance to be attached to the issue. And these communities provided the weakest support for Trump, a staunchly anti-climate candidate, in the 2016 and 2020 elections. In contrast, low vulnerability carbon economy communities provided the weakest support for climate policy. Moreover, these communities provided the strongest support for the climate change skeptic Trump in both elections. In addition, we saw that these opposing positions were moderated a bit in the low vulnerability knowledge economy communities, who were a bit less supportive of climate policy and a bit more supportive of Trump, and in the high vulnerability carbon economy communities, who were slightly more supportive of climate policy and slightly less supportive of Trump.

This theoretical argument and the empirical evidence stand in contrast to the prevailing narrative on American political polarization. This narrative holds that sociocultural rather than concerns about economic growth models and climate vulnerability drive polarization. Yet, recognizing that the intersection of the dual economy and the climate crisis is contributing to political division does not diminish the relevance of a sociocultural explanation. It does suggest, however, that we must begin to explore how these two sociocultural and material concerns intersect and interact to shape political behavior. Melcher (2021, 19) finds that "economic self-interest has a systematic and important effect on the formation of redistributive, class, and racial attitudes of Americans," one that "rivals and occasionally supersedes the effect of...racial resentment, and party identificantion and political ideology."

The need for additional work along these lines is strengthened by the recognition that the demographic group most directly threatened by decarbonization is the very same group most likely to perceive a status threat from immigration and other social changes: adult white males with relatively little formal education. In the fossil fuel energy industry, for instance, white males dominate the labor force. "As of 2019, non-Hispanic whites were 88 percent of oil and gas drilling workers, 91 percent of coal miners, 78 percent of petroleum refinery workers, 88 percent of construction workers, and 85 percent of electrical power generation and transmission workers" (Sicotte 2021). A similar lack of diversity characterizes carbon-intensive manufacturing industries. White males account for close to seventy-five percent of the labor force in the auto industry, for instance (Coffin and Lawrence 2020). And the auto industry is unusually diverse compared to the other durable goods manufacturing industries that dominate the carbon economy. Thus, shifting away from the carbon-intensive growth model removes the economic foundation that allowed white males with relatively little formal education to attain middle class status. The status threat that white males face, therefore, has an economic as well as a sociocultural component. This makes it very challenging to determine the underlying concerns that motivate individual political behavior.

To be clear, I am not concluding that individuals are narrowly motivated by their economic interests as defined by their location in the carbon-climate space when they vote for a presidential candidate. Nor am I suggesting that individual attitudes about climate change are a direct product of this location. On the one hand, any such conclusion would be rendered invalid by the ecological fallacy. On the other hand, it has proven difficult to find robust evidence that individuals support candidates or take policy positions based solely on their narrow economic interest (see Mansfield and Mutz 2009; Rho and Tomz 2017). We have even less evidence that climate change has been a salient issue in presidential elections. For that reason, additional research on the carbon-climate cleavage must test the causal hypothesis that varying exposures to carbon and climate *motivate* political activity. Teasing out such causal relationships, and in particular trying to untangle the connections between sociocultural and socioeconomic concerns in individual behavior will require a combination of survey experiments and community-level case studies.

Yet, even recognizing this important limitation, the county-level evidence points quite strongly to a carbon-climate cleavage in American politics. The divide in American politics is similar to spatial divide Arndt et al (2022) describe in the conclusion to their study of center-periphery cleavage in climate change attitudes in the European Union. "On the one hand, the progressive, egalitarian, metropolitan wealthy middle classes concerned about climate change and the environment are likely to abandon traditional left parties and opt green. On the other hand, the 'left behind' low-income individuals residing in poorer regions have no incentive to support policies that hurt them financially. Thus, they may opt for radical alternatives such as populist right-wing parties or far left parties concerned with equity, fairness and distribution" (Arndt et al 2022, 22). Hence, traditional left-right divisions organized around class that structured politics for much of the postwar period are upset by the emergence of climate change and the associated policy remedies.

In the American context, this division, as well as the factors that are creating it, are reminiscent of previous episodes of polarization that emerged during periods of rapid transitions in socioeconomic structure. In the late 19^{th} century the US shifted rapidly from a largely agrarian economy to an industrial economy (the original dual economy) and from a largely biomass based energy system to one based on fossil fuels. This transition gave rise to a significant populist revolt that pit western farmers against manufacturing and the western states against the northeast (see Frieden 1997). Populism in this era focused on critically important issues (gold, silver, and the monetary standard; commodity price stabilization), shaped presidential elections, and persisted from the 1880s through the 1930s. An even more extreme episode occurred in the mid-19^{th} century as the US outlawed slavery and dismantled the oppressive economic model upon which the wealth of southern plantation owners rested. The demise of the slave plantation pit sector against sector (cotton versus manufacturing and textiles) and region against region (southern states versus northern states) in ways that defined American politics (and that continue to do so). It is certainly the case that many southern whites who held no slaves opposed emancipation for reasons that had little to do with their narrow economic interests and much more to do with the status conferred by their identity as white men. Yet, nevertheless, most scholarship concludes that the underlying conflict concerned the maintenance of the slave plantation model in its current locations and its possible extension into other states, and not the individual racist views of impoverished southern white men.

Like our current era, these historical episodes saw a traditional economic sector and growth model enter terminal decline and the transition gave rise to political division and conflict that pit the declining regional economy against the expanding one. And in both cases, people living in communities dominated by the declining sector fought for policies that they believed would maintain the value of their property and sustain the incomes that at their existing standard of living. It might be useful to keep these historical cases in mind as America's transition away from the carbon economy, a transition that gains urgency from the climate crisis, gathers momentum.

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