Individualism and collective responses to climate change

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Abstract
This article establishes empirically that a persistent culture of “rugged individualism”, captured by exposure to the American westward-moving frontier from 1790 to 1890, undermines pro-climate perceptions, environmental performance, and climate change preparedness across counties in the United States. It also demonstrates that individualism is associated with environmental underperformance at the state level, making it more difficult to mitigate the far-reaching consequences of changing climate conditions. To establish external validity of the subnational evidence, I employ a global sample of up to 97 countries and provide suggestive evidence that individualism creates barriers to climate change responses worldwide.

JEL Classification: D78, H41, Q54, Q58

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1. Introduction

A prominent explanation of worldwide comparative development draws on the central role of cultural traits of individualism/collectivism in driving long-run economic growth (Spolaore and Wacziarg, 2013). Early contributions to this strand of literature postulate that individualism incentivizes technological innovation through awarding social status to individuals’ independence and accomplishments (Weber, 1958; Rosenberg and Birdzell, 2008). By contrast, collectivistic cultures, by emphasizing conformity and people’s subordination to a cohesive group, discourage individuals from standing out, thereby hampering innovation (Mokyr, 1990; Markus and Kitayama, 1991). Given the importance of technological innovation in sustaining productivity growth, previous studies suggest that collectivistic societies, relative to their individualistic counterparts, are more likely to suffer from economic backwardness (Gorodnichenko and Roland, 2017). However, it has been established that individualism is a barrier to resolving collective action problems, which critically depends on individuals’ propensity to internalize collective interests (Alesina and Giuliano, 2015). Against this background, this paper examines the extent to which cultural traits of individualism affect collective responses to climate change, which represents one of the most serious barriers to fostering sustainable development worldwide.

As defined by Gorodnichenko and Roland (2017, p. 402), culture is “the set of values and beliefs people have about how the world (both nature and society) works, as well as the norms of behavior derived from that set of values.” Existing studies also suggest that cultural values are important for shaping individuals’ climate change perceptions (Leiserowitz, 2006; Smith and Leiserowitz, 2013), thereby affecting cooperation in the climate commons. More broadly, it is argued that culture affects the social construction of risk and action, the feasibility of phasing out
carbon-intensive sectors, and the evolution of societal cohesiveness and populism (Hulme, 2009), potentially driving worldwide differences in climate change responses. Therefore, the exploration of the impact of culture on collective climate action helps improve our understanding of the challenges, opportunities, and dynamics of achieving ambitious emission-abatement commitments (Patterson, 2022). This is consistent with Ghosh’s (2017, p. 8) argument that a “broader imaginative and cultural failure … lies at the heart of the climate crisis.” There also exists ample evidence that slowly evolving cultural traits of individualism/collectivism are deeply rooted in historical pathogen prevalence (Fincher et al., 2008; Murray and Schaller, 2010) and ancestral farming practices (Ang, 2019; Buggle, 2020). The overly deterministic nature of culture implies that policy interventions toward changing historically determined individualistic cultures are largely infeasible. However, the effectiveness of contemporary policies is contingent on their compatibility with the prevailing cultural (historical) environment. Therefore, understanding how culture affects pro-climate action is important for designing effective responses to changing climate conditions. This line of reasoning points to the desirability of applying a “cultural origins” perspective in analyzing the driving forces of collective climate action.

Identification of the effect of individualism on collective climate action within a cross-country empirical framework is very challenging (Spolaore and Wacziarg, 2013; Gorodnichenko and Roland, 2017). This is because countries typically differ in numerous social, economic, and political characteristics, making it difficult to rule out alternative explanations. Against this backdrop, I leverage subnational variations in culture within the United States and investigate the role of a persistent culture of “rugged individualism” in driving substantial differences in climate behaviors and responses across American counties. This approach builds upon Turner’s (1893)
influential hypothesis positing that exposure to the west-ward moving frontier in early American history (1790 – 1890) led to the emergence and persistence of cultural traits of rugged individualism, including self-reliance, independence, and strong antipathy to redistribution and government regulations (Bazzi, Fiszbein, and Gebresilasse, 2020). I put forward the idea that rugged individualism is associated with more pervasive climate skepticism and less public support for emission-reducing policies, and hence hampers collective responses to changing climate conditions.

The main findings indicate that American counties with a more prevalence of rugged individualism are characterized by less public awareness of climate change and support for emission-abatement policies, environmental underperformance, and less climate change preparedness. The core results are robust to controlling for various county-level geographic/agroclimatic characteristics and accounting for selection bias from unobservables based on Oster’s (2019) coefficient stability test. Additionally, I follow Sequeira, Nunn, and Qian (2020) and Bazzi, Fiszbein, and Gebresilasse (2020) to use the climate-induced inflows of European immigrants to the United States from 1820 to 1890 as a plausibly exogenous instrument for rugged individualism. I also find that rugged individualism undermines beliefs in global warming and support for climate change policies at the individual level. Further evidence reveals that populism is a key mechanism underlying the main results. Additionally, I establish empirically that the baseline county-level evidence can be generalized across American states or world economies.

This research belongs to the existing literature on the long-term legacy of American frontier history for contemporary socio-economic, political, and cultural development in the United States (Turner, 1893; Bazzi, Fiszbein, and Gebresilasse, 2020). More recently, Bazzi, Fiszbein,
and Gebresilasse (2021) find that counties with greater frontier experience tend to suffer from less compliance with social distancing and mask wearing, and weaker responses to the COVID-19 pandemic at the local government level. This study builds upon Bazzi, Fiszbein, and Gebresilasse (2021) and demonstrates the influence of rugged individualism on collective inaction in the climate commons. My findings, therefore, complement and extend Bazzi et al.’s (2021) results in understanding the persistent influence of deep-rooted culture in shaping collective responses to climate change, which remains a major social challenge worldwide.

Furthermore, this paper contributes to an emerging line of research on the role of the cultural dimension of individualism/collectivism in shaping cross-country comparative development (Spolaore and Wacziarg, 2013; Gorodnichenko and Roland, 2017). A key distinguishing feature of this paper is to examine the impact of individualism on collective responses to climate change, which has been largely overlooked in the existing cross-country empirical literature.¹

The remainder of this study is organized as follows. Section 2 discusses the historical background and the main hypothesis. Section 3 contains the empirical framework, followed by the main results presented in Section 4. Section 5 provides additional evidence from state- and country-level analyses. Section 7 concludes the study.

2. Historical Background and the Economic Argument

American Frontier History and Cultural Traits of Rugged Individualism

According to the influential “frontier hypothesis” proposed by Turner (1893), the nature of contemporary social and political institutions in the United States was shaped overwhelmingly over a process of rapid population growth and westward expansion in early American history. More specifically, different waves of European settlements between 1790 and 1890 helped
accelerate the American westward-moving frontier line that separated sparsely populated settlements with less than two people per square mile from those with more (Porter, Gannett, and Hunt, 1890; Turner, 1893). More recently, Bazzi, Fiszbein, and Gebresilasse (2020) indicate that long-term exposure to the American frontier has a persistent influence on the prevalence of cultural traits of “rugged individualism”, consistent with Turner’s (1893) arguments. To capture the depth of historical experience with the American frontier, Bazzi, Fiszbein, and Gebresilasse (2020) follow Porter, Gannett, and Hunt (1890) to consider frontier counties as those with geographic proximity of less than 100 kilometers from the frontier line and population density of less than six people per square mile.

The above classification reflects two distinctive characteristics of frontier counties, including population sparsity and remoteness. Frontier counties were isolated from urban settlements in the east, which predominantly impeded interaction with the federal government. Furthermore, settlers in frontier counties could have suffered from a lack of social infrastructure. Thus, frontier life became “rough, crude, hard, and dangerous” (Overmeyer, 1944). The American westward-moving frontier triggered a self-selection process, where most independent and adventurous individuals were attracted to frontier counties. This ultimately gave rise to cultural traits of independence and self-reliance that were key to survival in frontier settlements (Bazzi, Fiszbein, and Gebresilasse, 2020). Additionally, resource abundance in frontier counties was conducive to independent farming and hence provided economic opportunities for upward mobility. Land abundance incentivized individualistic settlers to leave densely populated settlements in the east. This also contributed to the formation of beliefs that effort would facilitate upward mobility. Tax-based redistribution is typically considered unfair and inefficient within a society emphasizing the importance of effort (rather than luck) and with pervasive...
expectations of upward mobility (Piketty, 1995; Alesina and Angeletos, 2005). Therefore, counties with greater frontier experience tend to be characterized by strong antipathy to redistribution and government regulation (Bazzi, Fiszbein, and Gebresilasse, 2020).

**Rugged Individualism and Climate Change Responses**

The central hypothesis of this study is that rugged individualism gives rise to climate skepticism and opposition to climate change policies, and hence undermines responses to changing climate conditions in the United States. As articulated below, I draw upon the cultural theory of risk perceptions and American frontier history to understand how a persistent culture of rugged individualism helps shape the pattern of climate change responses across American counties.

Existing explanations of the role of culture in driving collective responses to climate change primarily rest upon cultural theory emphasizing that underlying worldviews and social values are central to shaping public perceptions of the risks of climate change (Leiserowitz, 2006; Smith and Leiserowitz, 2013). Cultural theorists postulate that people typically hold different worldviews, commonly defined as social, cultural, and political attitudes toward the world that play a key role in forming their risk perceptions and responses (Douglas and Wildavsky, 1982; Dake, 1992). For example, individualists place emphasis on autonomy and personal gain, and hence tend to oppose government regulation. For this reason, individualists typically display greater preferences for market-based strategies to maximize their independence and personal interests. Additionally, individualists are less likely to express a sense of responsibility toward other members of society. By contrast, group-oriented individuals value social order and discourage deviation from social norms that may undermine social hierarchies. Non-individualistic people tend to place greater trust on authority (e.g., experts, scientists, and the government) when it comes to risk assessments. This helps explain why rugged individualism is
associated with greater climate change skepticism and less public support for emission-abatement policies. Therefore, frontier counties may experience greater barriers to fostering collective responses to changing climate conditions.

The aforementioned enduring features of frontier settlements, including societal non-cohesiveness and strong anti-statism, also contribute to the prevalence of populism, thereby hindering climate change mitigation efforts. Bazzi, Fiszbein, and Gebresilasse (2020) empirically establish that populist leaders have obtained greater public support for populist movements across American counties through a transition toward less government redistribution. Given that social trust constitutes an important mechanism for risk-sharing in response to detrimental socio-economic shocks, societal non-cohesiveness arguably augments populist movements, reflected in rising opposition to globalization, immigration, and environmental issues, among others (Giuliano and Wacziarg, 2020). It has also been established that populist-oriented people tend to consider climate-related issues as elite-driven concepts, leading to greater climate change skepticism (Inglehart and Norris, 2017; Lockwood, 2018; Huber, 2020; Lübke, 2022).

In addition, climate skepticism is typically justified by the argument that climate policy is enacted by political elites for personal gain, intensified by conspiracy theories (Sussman, 2010; Lewandowsky, Oberauer, and Gignac, 2013; Huber, 2020). Therefore, climate change disbeliefs tend to prevail in many parts of the United States due to the persistence of distrust in political institutions and strong anti-statism (Lübke, 2022). This suggests that rugged individualism plausibly hinders collective responses to changing climate conditions by enhancing the prevalence of populist attitudes in the United States.

Consistent with theoretical predictions about the detrimental effect of rugged individualism on societal cohesion (Turner, 1893; Bazzi, Fiszbein, and Gebresilasse, 2020), previous studies
have established that frontier experience undermines the implementation of effective responses to the COVID-19 pandemic of the local government and individual compliance with virus-containment policies and measures (Bazzi, Fiszbein, and Gebresilasse, 2021). The conventional view is that addressing climate change critically requires cooperation in reducing CO$_2$ emissions (Carattini, Levin, and Tavoni, 2019). Thus, collective responses to changing climate conditions are primarily hampered by free-rider fears due to individuals’ temptation to free-ride on other players’ cooperative efforts (Bohr, 2014). This argument builds upon Ostrom (1990, 2000) positing that social norms of reciprocal trust and cooperation play an important role in strengthening climate change mitigation efforts. These narratives reveal that rugged individualism, by undermining social cohesiveness, reduces individuals’ propensity to internalize the externalities of their actions, making it difficult to sustain cooperation in the climate commons.

3. Data and Empirical Specification

The Baseline Model

To examine the impact of rugged individualism on collective responses to climate change in the United States, I estimate the following cross-sectional model:

$$\text{CC}_i = \alpha + \beta \text{TFE}_i + \tau \text{Controls}_i + \varphi_i + \epsilon_i,$$

[1]

where $\text{CC}_i$ is a vector of climate change perceptions and responses for county $i$, including the estimated percentages of people with climate change beliefs and policy support, environmental performance, and climate change preparedness; $\text{TFE}_i$ is total frontier experience; $\text{Controls}_i$ denotes a set of geographical/agroclimatic covariates; $\varphi_i$ is a vector of state dummies; and $\epsilon_i$
is an unobserved county-specific disturbance term. $\beta$ captures the effect of rugged individualism on climate change perceptions and responses across American counties. Appendix Table A1 contains descriptive statistics of key variables.

**Data**

*Rugged Individualism*

I employ TFE as a historically determined measure of the prevalence of rugged individualism in the United States. Specifically, the process of population growth and territorial expansion to the west in early American history was driven by various waves of European settlements, leading to the cross-county variation in exposure to the westward-moving frontier. Bazzi, Fiszbein, and Gebresilasse (2020) exploit the length of time a county spent at the American frontier between 1790 and 1890 to capture cross-county differences in the pervasiveness of rugged individualism. For this purpose, Bazzi, Fiszbein, and Gebresilasse (2020) construct a binary indicator for each county in a given year from 1790 to 1890 taking a value of one if a county was on the American frontier (based on population density and geographic proximity to the frontier as articulated in Section 2), and zero otherwise. The pervasiveness of rugged individualism is measured by the length of time (in decades) of frontier exposure of each county across the period 1790 – 1890. Higher values of TFE correspond to a greater prevalence of cultural traits of independence, self-reliance, and strong anti-statism.

*Climate Change Perceptions and Responses*

The exploration of the effect of rugged individualism on climate change responses in the United States exploits several measures of climate change skepticism and policy support, environmental performance, and climate change preparedness. Higher values of these variables reflect greater
beliefs in climate change and public support for emission-reducing policies, and better environmental performance and climate change preparedness at the county level. I employ a comprehensive dataset on climate behaviors provided by Howe et al. (2015) to capture climate change perceptions. More specifically, Howe et al. (2015) use several nationally representative surveys on climate behaviors to estimate multilevel regression models of the effect of demographic and geography-level characteristics on surveyed respondents’ attitudes toward climate change, such as beliefs, risk perceptions, and policy support. These estimates are utilized to predict average climate change opinions for each population (demographic) type in each geographic unit. County-level measures of climate-related attitudes are then calculated as the weighted average of each model-projected opinion for each population type, where the weight corresponds to the actual proportional representation of each population type in a county obtained from population statistics of the United States Census Bureau. I use the estimated percentages of adults who answered ‘yes’ to the questions that “Do you think that global warming is happening?” (CC_real) and “Assuming global warming is happening, do you think it is caused mostly by human activities?” (CC_human). I also calculate the first principal component of the estimated percentages of survey participants who express support for 15 different climate change policies and measures (Polsup).

In addition, I adopt county-level proxies for environmental performance and climate change preparedness as alternative dependent variables. This provides an intuitive approach to examining whether counties with greater frontier experience are less prepared to address the far-reaching consequences of climate change and have poorer environmental performance due to the prevalence of rugged individualism. More specifically, I exploit the environmental quality index (EQI) to measure cross-county differences in environmental performance. EQI reflects
environmental quality in five domains, including air, water, land, built, and sociodemographic environments. It is plausible that counties with better environmental performance are more likely to adopt stringent emission-reducing policies and measures in response to changing climate conditions. Additionally, I use an index of climate change preparedness (CPI) that captures resilience to climate change at the county level, reflected in the quality of governance, and built and natural environments relevant for climate change mitigation. Data on these variables are obtained from the United States Environmental Protection Agency.

Control Variables

To attenuate plausible concerns about omitted variable bias, I augment the benchmark model with several geographic/agroclimatic controls. It is plausible that fundamental (fixed) geographical attributes help shape the early formation and persistence of rugged individualism, and contemporary comparative cross-county development in the United States. Therefore, the inclusion of county-specific geographical characteristics in the regressions helps rule out the possibility that my findings are exclusively driven by the long-term legacy of geography. Following Gorodnichenko and Roland (2017, 2021), Bazzi, Fiszbein, and Gebresilasse (2020), and Vu (2021), I control for latitude and longitude of a county’s centroid, average temperature, precipitation, elevation, terrain ruggedness, potential crop yield, and rainfall risk, and distances to coast, rivers, and lakes from a county’s centroid. Furthermore, I incorporate state dummies in the regression to account for unobserved (time-invariant) heterogeneity across American states.

4. Main Results

OLS Estimates
Table 1 presents estimates of Equation [1]. In Columns (1) to (3), I regress CC_real, CC_human, and Polsup on TFE. The results in Columns (4) and (5), respectively, reflect the long-term impact of deep-rooted cultural traits of rugged individualism on EQI and CPI. All the regressions are augmented with fundamental (fixed) geographic attributes and state fixed effects. Accordingly, TFE enters all the regressions with a negative and statistically significant coefficient. The main findings are also robust to accounting for several county-level geographical/agroclimatic attributes and unobserved state-specific factors. The baseline estimates suggest that counties with greater frontier experience tend to have lower estimated percentages of people who exhibit climate beliefs and support for climate change mitigation efforts, ceteris paribus (Appendix Figure A1). Rugged individualism also undermines environmental performance and climate change readiness at the county level, holding other things equal (Appendix Figure A1). This lends support to the main hypothesis that cultural traits of rugged individualism hamper collective responses to climate change.

[[Insert Table 1 about here]]

The baseline OLS estimates are suggestive of the economic significance of the effect of TFE on climate change responses. Specifically, the standardized beta coefficient on TFE in Column (1) indicates that a one-standard-deviation increase in TFE is associated with an approximately 0.216-standard-deviation decrease in CC_real (Table 1). In other words, an additional decade spent at the American frontier between 1790 and 1890 is linked to a roughly 1.050-percentage-point decrease in the predicted percentage of people who express climate change beliefs within a county. The size of this effect corresponds to approximately 20% of a standard deviation of CC_real across county observations, which is a sizeable influence. Illustratively, a one-standard-deviation difference in TFE equates to the difference between Dooly County and Ware County in
Georgia, of which the values for TFE are 5 and 6.1, respectively. The predicted percentage of people who believe that global warming is happening in Dooly is 68.51%, which is higher than the figure for Ware (66.77%). If Dooly were to experience a score of TFE similar to that of Ware, the value of CC_real of Dooly would decrease by approximately 1.155 percentage points from 68.51% to 67.35%. This corresponds to nearly 21.2% of a standard deviation of CC_real.

The magnitude of the effect of TFE on collective climate action is larger when Polsup is used as a dependent variable. A recent study by Dechezleprêtre et al. (2022) reveals that beliefs in climate change do not necessarily translate into public support for a wide range of pro-climate policies and measures. Even when individuals exhibit climate change beliefs, their support for climate change policies depends on the perceived effectiveness (Sælen and Kallbekken, 2011), distributional impacts (Bergquist, Mildenberger, and Stokes, 2020), and impacts on one’s household of emission-abatement policies (Umit and Schaffer, 2020). Hence, fostering public support for emission-reducing policies and measures, which typically requires internalizing the externalities of individuals’ actions, appears more challenging than improving climate change awareness. Consistent with the main hypothesis, these narratives help explain why cultural traits of self-reliance, independence, and strong anti-statism create more serious barriers to strengthening public support for climate change policies, compared to fostering beliefs in global warming.

Unobservable Selection

I now implement the coefficient stability test developed by Oster (2019) to assess the scale of selection bias from unobservables. Oster (2019) argues that the conventional approach to ruling out concerns about omitted variable bias by including observed controls in the regression analysis may not provide reliable inference when observed confounding factors are imperfect.
proxies for the true omitted covariates. In this regard, one could argue that several geographical factors incorporated in Equation [1] are incomplete proxies for the true variation in numerous geographic characteristics across American counties. Therefore, I follow Oster (2019) to check whether my findings can be easily explained away by selection on unobservables, as presented in Table 1.

The method proposed by Oster (2019) exploits coefficient stability and the empirical relevance of control variables to assess the scale of bias from unobservables. I first calculate the coefficient of proportionality ($\delta$), which corresponds to the importance of unobservables, relative to observables, in attenuating the baseline coefficient on TFE toward zero ($\beta = 0$). When using Polsup as the dependent variable, $\delta = 206.28$ indicates that the correlation between unobserved confounders and TFE needs to be implausibly stronger than the correlation between observed controls and TFE to explain away the core results. Consistent with the suggestion of Oster (2019), the value for $\delta$ greater than 1 implies that my findings are not easily confounded by selection on unobservables, except in Column (5). Next, I construct the bias-adjusted coefficient ($\beta^*$), which would capture the effect of TFE on climate change responses if one were to account for all unobserved confounders in the regression. However, none of the intervals bounded by $\beta^*$ and the baseline coefficient contains zero, except in Column (5). These results help rule out the possibility that my findings are not purely driven by unobserved confounding characteristics.

**Instrumental Variable Estimates**

A key challenge with estimating Equation [1] is that American counties differ in numerous contemporary and historically persistent dimensions of social, economic, political, and cultural
development. It is largely impossible to identify and include all potential confounding characteristics in the regressions. Furthermore, capturing the cross-county variation in culture can be subject to measurement errors, thus offering an invalid basis for statistical inference.\textsuperscript{6}

To move closer to causal inference, I follow Sequeira, Nunn, and Qian (2020) and Bazzi, Fiszbein, and Gebresilasse (2020) to isolate a plausibly exogenous source of variation in TFE that helps explain the divergence in climate change responses across American counties. I employ the predicted inflows of European immigrants to the United States between 1820 and 1890 (Pdmig) exogenously driven by historical shocks to climate conditions in Europe as an instrumental variable (IV) for TFE. This strategy rests upon the premise that Pdmig affected counties’ exposure to the American frontier by shaping the time it took for frontier counties to become established settlements (Bazzi, Fiszbein, and Gebresilasse, 2020). More specifically, climate shocks in Europe led to an increase in emigration flows to the United States and hence higher population pressure in eastern settlements. This helped accelerate the process of westward expansion in early American history, thereby reducing the length of time spent on the American frontier for counties that happened to be on the frontier when exogenous climate shocks occurred in Europe. Therefore, Pdmig is a relevant IV for TFE. In line with Sequeira, Nunn, and Qian (2020), Bazzi, Fiszbein, and Gebresilasse (2020) construct Pdmig at the county level by first estimating various country-specific regressions to predict the emigration flows from each of 16 European countries to the United States between 1820 and 1890 induced by climate shocks in the home country. For each county, Bazzi, Fiszbein, and Gebresilasse (2020) identify the first year when it was within 100 kilometers of the frontier belt, and then calculate the total national inflows of European immigrants to the United States in the next 30 years.\textsuperscript{7} Furthermore, Pdmig driven purely by exogenous climate shocks in Europe may affect contemporary comparative
socio-economic development within the United States exclusively through shaping exposure to the American frontier.

Table 2 contains IV-2SLS estimates. The first-stage results in Panel B indicate that Pdmig has a negative and statistically significant effect on TFE. This suggests that higher values of Pdmig over a period of 30 years commencing just before a county was exposed to frontier life are associated with a less prevalence of rugged individualism. For this reason, Pdmig is a relevant IV for TFE. Consistent with the OLS estimates, I find that the plausibly exogenous component of TFE has a negative impact on different measures of climate change perceptions, environmental performance, and preparedness for climate change (as reported in Panel A). In addition, the estimated coefficient on TFE is statistically significant at the 1% level, except in Column (4). To mitigate concerns about weak instrument bias, I report the first-stage $F$-statistic of excluded instrument, which is much larger than the rule-of-thumb value of 10 in all cases. Following Andrews, Stock, and Sun (2019), I also calculate identification-robust Anderson-Rubin confidence intervals, which provide reliable inference on the relationship between TFE and collective climate action regardless of the strength of the IV in the reduced-form models. Except in Column (4), all these bound estimates exclude zero, thus lending further support to the main hypothesis.

\[[\text{Insert Table 2 about here}]\]

Compared to the OLS results, the point estimate of the coefficient on TFE becomes much larger in magnitude in most IV specifications. In particular, the results in Column (3) indicate that an extra standard deviation of TFE is associated with a 0.332-standard-deviation decrease in Polsup (Table 2). There are several plausible explanations. First, resistance to pro-climate action might have persisted throughout history. If historically persistent norms of collective inaction
contributed to the emergence and prevalence of rugged individualism, the estimated coefficient on TFE in the OLS regressions may be biased. Second, counties with greater frontier experience are more likely to experience pervasive norms of religiosity because settler frontiers could turn to religion to cope with rough and dangerous life conditions in the frontier line (Bentzen, 2019). It has been established that religiosity gives rise to distrust in science, thus undermining climate change beliefs and policy support and the adoption of national climate change policies (Smith and Leiserowitz, 2013; Sharma, Ang, and Fredriksson, 2021). If these unobserved (or observed but imprecisely measured) historically persistent norms of religiosity contribute to prevailing collective climate inaction in the United States, the OLS estimates can suffer from attenuation bias. Nevertheless, previous studies are also suggestive of a positive association between religious beliefs and pro-environmental behavior (see, for example, Naess, 1990; Whitney, 1993; Arbuckle and Konisky, 2015; Schaefer, 2016). As such, the baseline OLS estimates are subject to an upward bias, which is consistent with the observed difference in the estimated coefficients on TFE as reported in Tables 1 and 2. Finally, the historically determined measure of rugged individualism can be subject to measurement errors; thus, the coefficient on TFE in the OLS regressions is biased toward zero.

Interpreting the IV estimates critically requires attention to the assumption that Pdmig affects the outcome variables exclusively through shaping TFE. However, the validity of the exclusion restrictions cannot be tested empirically due to the unobserved nature of the disturbance terms. A potential threat to identification relates to the possibility that climate shocks in Europe might have led to the prevalence of cultural traits of non-cooperation among Europeans who migrated to the United States. This argument draws on the premise that individuals who suffer from unpredictable and unbearable life conditions tend to exhibit more
religious beliefs and distrust in science (Bentzen, 2019), thus hampering collective climate action. To the extent that European settlers brought with them cultural norms of collective climate inaction to American frontier counties, the IV estimates could offer an invalid basis for statistical inference due to potential violations of the exclusion restrictions. Addressing the above concern requires measuring historically persistent cultural norms of collective inaction induced by climate shocks in Europe from 1820 to 1890; however, this exercise is very challenging. It is important to note that all the IV regressions are augmented with contemporary mean annual temperature and precipitation, the variance of the annual average monthly rainfall between 1895 and 2000, and several other geographic/agroclimatic attributes. Consistent with Turner’s (1893) hypothesis that different waves of European settlers contributed to the emergence of distinct cultural norms in the United States attributed to exposure to frontier life conditions, controlling for county-level fundamental (fixed) geographical characteristics at least partially mitigates the problem that climate conditions in American counties directly matter for today’s pro-climate action.

To mitigate plausible concerns about deviation from the exclusion restrictions, I employ the union of confidence intervals approach of Conley, Hansen, and Rossi (2012) to estimate the upper and lower bounds of the effect of TFE on collective climate action in the United States. Specifically, the exogeneity condition is satisfied when the parameter $\gamma$ is indistinguishable from zero ($\gamma = 0$) in the following structural model specification:

$$CC_i = \alpha + \beta TFE_i + \gamma Pdmig + \tau Controls_i + \varphi_i + \epsilon_i.$$  

[2]

Following Conley, Hansen, and Rossi (2012), under the assumption that $\gamma \neq 0$, it would be possible to obtain reliable inference on $\beta$ allowing for partial deviation from the exclusion
restrictions if one were to know the true direct effect of the instrument on the outcome variables. As such, Equation [2] can be estimated using Pdmig as an IV for TFE.\textsuperscript{10} Because $\gamma$ is unknown, it is assumed to take values within a specific support interval ($\gamma \in [-2\delta, 2\delta]$). Therefore, the IV regressions can be implemented for different hypothesized values of $\gamma$. Additionally, it is assumed that $\gamma \sim N(0, \delta^2)$, following Conley et al.’s (2012) local to zero approach. The 95% confidence intervals of $\beta$ are reported in Table 2. I assume that the direct effect of Pdmig on the outcome variables corresponds to between 20% and 80% of the partial effect of TFE on the dependent variables in the benchmark IV regressions. For example, CI $(2\delta = 20\%)$ reflects Conley et al.’s (2012) bound estimates of TFE when I assume that the direct effect of Pdmig is up to 20% of the estimated partial effect of TFE. Accordingly, the coefficient on TFE remains precisely estimated at conventional levels of statistical significance, except in Column (4), when I allow for partial deviation from the exclusion restrictions. Even when I allow for implausibly large violation of the exogeneity requirements ($2\delta = 80\%$), the IV results retain their sign and statistical precision in most cases. These results at least partially mitigate plausible concerns about deviations from the exclusion restrictions.

**Sensitivity Analysis**

The Online Appendix contains the results and detailed interpretations of several empirical exercises implemented to check for the robustness of the main findings. First, I incorporate additional control variables in the benchmark model to further mitigate plausible concerns about omitted variable bias. Specifically, I augment the regression analysis with contemporary socio-economic characteristics (Appendix Table A2) and historical confounding factors (Appendix Table A3). Second, I rule out the possibility that the core results are confounded by spatial autocorrelation by clustering the standard errors at the 60-square-mile grid cell level, calculating
Conley’s (1999) standard errors, and estimating spatial-autoregressive models with spatial-autoregressive error terms (Appendix Table A4). Third, I check whether the results withstand excluding or down-weighting outlier observations (Appendix Table A5). Fourth, I check for robustness to employing alternative county-level proxies for individualism (Appendix Table A6). Fifth, following Chetty and Hendren (2018) and Leonard and Smith (2021), I account for unobserved (time-invariant) heterogeneity across commuting zones (Appendix Table A7). Finally, I explore potential regional heterogeneity in the core results using frontier experience accumulated over the baseline (1790 – 1890) and extended (1790 – 1950) periods in early American history (Appendix Table A8). However, the benchmark estimates remain insensitive in most cases.

**Individual-Level Evidence**

I now conduct several individual-level analyses to investigate whether people residing in counties with greater frontier experience are less likely to exhibit climate change beliefs and support for pro-climate action. This approach allows for controlling for individuals’ social, economic, and demographic characteristics that are central to shaping pro-environmental attitudes (Longhi, 2013; Hornsey et al., 2016; Poortinga et al., 2019; Lübke, 2022). It is noteworthy that the county-level measures of climate-related perceptions adopted in the main analysis are predicted from multilevel regressions. Therefore, they can be noisy proxies for the variation in climate change attitudes across American counties. This necessitates using alternative variables capturing the spatial distribution of climate change perceptions and responses in the United States.
I employ data from three waves of the Cooperative Congressional Election Study Panel Survey (CCES) spanning the period 2010 – 2014 to examine the effect of TFE on surveyed respondents’ climate-related attitudes. I follow Meyer (2022) to set up the following model:

$$P(CC_{idvict} = 1|X) = \alpha + \beta TFE_c + \rho \text{Controls}_{ict} + \gamma Z_c + \varphi_s + \mu_t + \epsilon_{ict},$$

[3]

where $CC_{idvict}$ stands for pro-climate behaviors of individual $i$ residing in county $c$, and participating in wave $t$ of CCES; $TFE_c$ is total frontier experience of county $c$; $\text{Controls}_{ict}$ represents a set of individuals’ socio-demographic and economic characteristics, including gender, age, employment status, educational attainments, marital status, self-reported importance of religion, and dummies variables for race/ethnicity; consistent with the main analysis, I control for county-level geographic/agroclimatic characteristics ($Z_c$) and state dummies ($\varphi_s$); $\mu_t$ captures unobserved survey wave-specific factors; and $\epsilon_{ict}$ is an individual-specific disturbance term. I match county-level data to CCES based on respondents’ county of residence.

To capture pro-climate behaviors, I exploit responses to the following question: “From what you know about global climate change or global warming, which one of the following statements comes closest to your opinion?” Responses to this question include (i) “Global climate change has been established as a serious problem, and immediate action is necessary”, (ii) “There is enough evidence that climate change is taking place and some action should be taken”, (iii) “We don’t know enough about global climate change, and more research is necessary before we take any actions”, (iv) “Concern about global climate change is exaggerated. No action is necessary”, and (v) “Global climate change is not occurring; this is not a real issue”. I create a dummy variable taking a value of one if survey participants’ responses are coded as (i) or (ii), and zero otherwise ($CC_{idv1}$). I also use an alternative dependent variable assigned a value of one (zero)
if surveyed respondents vote for (against) imposing a cap on carbon emissions and providing funding for research on renewable energy (CC_idv2).

Probit estimates of the effect of TFE on individual-level pro-climate attitudes are reported in Table 3. TFE enters all the regressions with a negative and statistically significant coefficient. This suggests that individuals residing in counties with greater frontier experience are less likely to believe in climate change or support climate change mitigation policies, holding other things equal. This finding is also insensitive to controlling for an exhaustive set of individual- and county-level confounding characteristics. As shown in Columns (2) and (4), the sample-wide average marginal effect indicates that an additional decade spent at the American frontier is estimated to reduce the probability that surveyed respondents of CCES believe in climate change and support for pro-climate action by nearly 2% (Table 3). Overall, the individual-level evidence lends additional support to the central hypothesis that a persistent culture of rugged individualism creates barriers to strengthening collective responses to changing climate conditions.

**Potential Mediating Mechanisms**

This section discusses additional county-level analyses of potential mechanisms underlying the main hypothesis. Specifically, I first examine whether TFE gives rise to the prevalence of populism and societal non-cohesiveness, thus undermining collective climate action in the United States. I capture county-level populism by Trump’s vote share in the 2016 Presidential election. Furthermore, I employ the social capital index developed by the social capital project of the United States Joint Economic Committee to measure the cross-county variation in social
cohesiveness. Following Bauernschuster, Falck, and Woessmann (2014), Guiso, Sapienza, and Zingales (2004), and Putnam (1993, 2001), I use a county-specific measure of voting turnout averaged between 2012 and 2020 as an alternative proxy for social cohesion. Then, I re-estimate Equation [1] but use populism and social cohesiveness as alternative outcome variables. Figure 1 depicts the point estimate and 95% confidence interval of the coefficient on TFE. Accordingly, rugged individualism has a positive and negative impact on populism and social cohesiveness, respectively. The results are also robust to controlling for several geographic/agroclimatic attributes and state fixed effects. This suggests that deep-rooted cultural traits of rugged individualism hamper climate change mitigation efforts through inducing the prevalence of populism and social non-cohesiveness in the United States.

I also exploit individual-level data from various waves of CCES to explore the role of TFE in shaping populist attitudes and civic engagement. To this end, I use surveyed respondents’ vote share and favorability of Donald Trump to capture individuals’ populist attitudes. These two outcome variables take a value of one for survey participants expressing favorable rating of Trump in the pre-election phase and having voted for Trump in the Presidential primary or general elections, and zero otherwise. I also use a dummy variable taking a value of one for respondents voting in the Presidential elections between 2006 and 2020, and zero otherwise. I replicate the specification in Equation [3] but use these measures of populism and civic engagement as alternative outcome variables. The individual-level evidence reported in Appendix Table A9 indicates that rugged individualism is associated with the prevalence of populist attitudes and societal non-cohesiveness, thereby undermining collective climate action in the United States.
I also examine how much of the long-term legacy of TFE for climate change responses can be attributed to populism and societal non-cohesiveness. For this purpose, I apply a two-stage estimation procedure following Acharya et al.’s (2016) adoption of sequential g-estimation. The first-stage regression requires estimating the effect of TFE on the outcome variable controlling for the proposed mechanism (mediator) and a set of confounding characteristics, including pre-treatment controls and post-treatment intermediate confounders. Then, I transform the outcome variable by subtracting the estimated effect of the mediator. The second-stage regression involves estimating the effect of TFE on the transformed outcome variable accounting for pre-treatment covariates; all intermediate confounders are excluded from the regressions. This yields the average controlled direct effect (ACDE) of TFE on pro-climate action, reflecting the impact of TFE on climate change perceptions and responses holding the proposed mediator fixed at a particular level.

Appendix Table A10 contains estimates of the ACDE of TFE on pro-climate action. Accordingly, the effect of TFE on CC_real and CPI turns out to be imprecisely estimated at conventional levels of statistical significance when I partial out the impact of populism. However, the sign and magnitude of the estimated coefficient on TFE remain largely stable in other specifications. This provides partial evidence that rugged individualism affects pro-climate action primarily through giving rise to populist attitudes. It is noteworthy that accounting for the proposed mechanisms does not alter the size and statistical precision of the estimated effect of TFE on CC_human, Polsup, and EQI. Hence, rugged individualism may directly matter for climate change responses as individualists, compared to their non-individualistic counterparts, are less likely to internalize the externalities of their actions and hence exhibit climate inaction. An alternative explanation is that the main results can be mediated by other mechanisms.
5. Extensions

Evidence from State-Level Analyses

Achieving ambitious targets in reducing emissions is conditional on cooperation between various actors at the national and local levels. The preceding analyses are suggestive of the key role of rugged individualism, captured by exposure to the American frontier, in shaping county- and individual-level cooperation in the climate commons. However, significant climate change mitigation efforts are undertaken at the state level; there also exist substantial differences in climate change commitments across American states (Basseches et al., 2022). This section, therefore, complements the main analysis by investigating the correlation between individualism and climate change responses at the state level.

For this purpose, I need to obtain a state-level proxy for the prevalence of individualistic traits. It has been established in the social psychology literature that the adoption of uncommon names reflects individuals’ desire to be unique and deviate from norms and traditions (Twenge, Abebe, and Campbell, 2010).\(^{17}\) Therefore, I employ a state-specific measure of the prevalence of infrequent names constructed by Mohanty and Ang (2023) to capture the variation in individualism across American states. Specifically, Mohanty and Ang (2023) exploit data on the frequency of baby names registered between 1910 and 2018 from the United States 2019 Social Security Administration to construct a state-level measure of individualism based on the absence of top 100 common names of each birth batch. I also use the intensity of energy-related CO\(_2\) emissions to capture state-level environmental performance and commitments to climate change mitigation.\(^{18}\) This rests upon the argument that states with higher levels of CO\(_2\) emissions tend to experience greater barriers to implementing stringent emission-abatement policies.
I set up the following econometric model to estimate the relationship between individualism and climate change responses at the state level:

\[
\text{Emissions}_s = \alpha + \beta \text{IDV}_s + \tau \text{Controls}_s + \varepsilon_s,
\]

where \( \text{Emissions}_s \) is the intensity of energy-related CO\(_2\) emissions in 2020 of state \( s \); \( \text{IDV}_s \) is the absence of top 100 common names; I incorporate a set of state-level geographical/agroclimatic characteristics in the regression, including latitude and longitude of a state’s centroid, average temperature, precipitation, elevation, terrain ruggedness, potential crop yield, and rainfall risk, and distance to coast; and \( \varepsilon_s \) is a state-specific error term.

Figure 2 depicts OLS estimates of the partial correlation between individualism and CO\(_2\) emissions across American states. Accordingly, IDV enters the regression with a positive and statistically significant coefficient. This reveals that more individualistic states are characterized by poorer environmental performance, ceteris paribus. Additionally, I re-estimate Equation [4] but use CO\(_2\) emissions intensity measured for each year between 1970 and 2020 as alternative outcome variables. To conserve space, I plot the results derived from estimating various repeated cross-sectional regressions in Figure 3. Accordingly, the coefficient on IDV is positive and precisely estimated at conventionally accepted levels of statistical significance in all cases. Overall, these additional estimates are in line with the main results documenting that individualism creates long-term barriers to strengthening collective responses to climate change. It is noteworthy that these additional estimates may not carry a causal interpretation due to concerns about omitted variable bias and/or measurement errors in the state-level index of
individualism. Nevertheless, these results at least partially indicate that the county-level evidence can be generalized across states.

[[Insert Figure 3 about here]]

**External Validity: Global Evidence**

I now explore whether the main findings can be generalized across the globe. In line with the preceding state-level analysis, I examine the cross-country relationship between individualism and environmental performance using a global sample of up to 97 countries, which is dictated by data availability. Specifically, I employ Hofstede’s (2001) measure of the cultural dimension of individualism/collectivism. It captures the prevalence of individualistic traits based on the perception that “people are supposed to take care of themselves and of their immediate families only” (Hofstede, 1980, p. 45). By contrast, collectivism places emphasis on individuals’ subordination to a cohesive group and the interdependence between group members for survival and social security (Hofstede, 1980). This implies that people in individualistic societies tend to value personal autonomy and achievements, whereas people in collectivistic societies tend to believe in the importance of conformity and group harmony. The country-level index of individualism ranges from 0 to 100; countries with higher values are more individualistic. I also use the intensity of CO₂ emissions averaged between 2000 and 2015 to capture environmental performance and countries’ climate change mitigation efforts.²⁰

I specify the following econometric model to examine the cross-country correlation between individualism and environmental performance:

\[
\text{Emissions}_c = \alpha + \beta \text{IDV}_c + \tau \text{Controls}_c + \gamma \text{Continent}_c + \epsilon_c,
\]

[5]
where $\text{Emissions}_c$ is the intensity of CO$_2$ emissions for country $c$; $\text{IDV}_c$ is the country-level index of individualism; $\text{Controls}_c$ denotes a set of geographical/agroclimatic characteristics at the country level; $\text{Continent}_c$ is a vector of binary indicators for continents; and $\epsilon_c$ is a country-specific disturbance term. Following previous studies in the long-term comparative development literature (Spolaore and Wacziarg, 2013; Gorodnichenko and Roland, 2017), I augment Equation [5] with different geographical/agroclimatic attributes, including absolute latitude, distance to nearest waterway, terrain ruggedness, a dummy variable for island nations, average annual values of temperature and precipitation between 1960 and 2016, and the average and range of both land suitability for agriculture and elevation. Additionally, I incorporate dummy variables for Europe, Asia, North America, South America, and Oceania (Africa is the base group) in the regression to account for unobserved (time-invariant) heterogeneity across world regions.

Figure 4 illustrates estimates of Equation [5]; the full estimates are available on request. Accordingly, there is a positive correlation between individualism and environmental performance across countries, controlling for geographical/agroclimatic characteristics and continent dummies. The results suggest that individualistic countries, relative to their collectivistic counterparts, tend to be characterized by poorer environmental performance, holding other things equal. The interpretation of the cross-country estimates depicted in Figure 4 critically requires attention to endogeneity bias stemming from failure to control for relevant confounders and/or measurement errors in Hofstede’s (2001) individualism index. While I openly recognize the difficulty of ruling out alternative explanations of cross-country differences in environmental performance, the additional cross-country estimates provide some suggestive
evidence that the main findings can be generalized across world economies. This is consistent with the central hypothesis positing that cultural traits of individualism hamper collective responses to changing climate conditions.

6. Concluding Remarks

This study examines the deep cultural origins of climate change responses. It exploits subnational variations in a persistent culture of rugged individualism to explain substantial differences in pro-climate action in the United States. I postulate that cultural traits of rugged individualism, including self-reliance, independence, and strong anti-statism, negatively affect public awareness of the risks of climate change, thereby reducing individuals’ propensity to support emission-abatement policies and measures. Additionally, rugged individualism is linked to societal non-cohesiveness and populism, which ultimately undermine collective responses to climate change.

Using county-level data, I find that the prevalence of rugged individualism, captured by long-term exposure to the American westward-moving frontier from 1790 to 1890, hampers climate change beliefs and policy support, environmental performance, and climate change preparedness. The individual-level evidence also suggests that people residing in counties with greater frontier experience are less likely to believe in climate change and support pro-climate action. In line with the main hypothesis, I document that rugged individualism translates into collective climate inaction primarily through giving rise to the prevalence of populist attitudes across American counties. I also implement numerous state-level analyses and demonstrate that individualistic states, relative to their non-individualistic counterparts, are characterized by poorer environmental performance. Using a global sample of up to 97 countries, I find that individualistic countries tend to suffer from environmental underperformance and hence face
greater barriers to fostering climate change mitigation efforts, compared to countries with more prevalent collectivistic cultures. These results reveal that addressing climate change requires attention to the long-term legacy of the cultural dimension of individualism/collectivism for climate change responses.
Acknowledgements

I would like to thank two anonymous reviewers for their constructive comments and helpful suggestions. I am also grateful to Duc Trung Do (Bangor University) for his kind support when revising the paper. All errors remain my responsibility.

References


Table 1
Rugged Individualism and Collective Climate Action at the County Level, OLS Estimates

<table>
<thead>
<tr>
<th>Collective climate action</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>CC_real</td>
<td>CC_human</td>
<td>Polsup</td>
<td>EQI</td>
<td>CPI</td>
</tr>
<tr>
<td>Panel A. OLS estimates. Dependent variable: collective climate action</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TFE</td>
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<td>-0.954***</td>
<td>-0.683***</td>
<td>-0.124***</td>
<td>-0.003**</td>
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<td>(0.119)</td>
<td>(0.100)</td>
<td>(0.066)</td>
<td>(0.018)</td>
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<td>Latitude</td>
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<td>(0.096)</td>
<td>(0.081)</td>
<td>(0.056)</td>
<td>(0.016)</td>
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<td>-0.340**</td>
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<td>(0.243)</td>
<td>(0.228)</td>
<td>(0.145)</td>
<td>(0.045)</td>
<td>(0.003)</td>
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<tr>
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<td>(1.272)</td>
<td>(0.831)</td>
<td>(0.248)</td>
<td>(0.016)</td>
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<td>-0.002**</td>
<td>-0.001**</td>
<td>0.0005**</td>
<td>-0.00003**</td>
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<td>(0.001)</td>
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<td>-2.711</td>
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<td>(3.267)</td>
<td>(2.882)</td>
<td>(1.864)</td>
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<td>Rainfall risk</td>
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<td>(11.215)</td>
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<td>(6.740)</td>
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<tr>
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<td>(0.105)</td>
<td>(0.068)</td>
<td>(0.021)</td>
<td>(0.001)</td>
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<td>(0.023)</td>
<td>(0.001)</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Observations (# of counties)</td>
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<td>2,036</td>
<td>2,036</td>
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<td>R-squared</td>
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<td>0.606</td>
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<tr>
<td>Standardized coefficient of TFE</td>
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<td>-0.227</td>
<td>-0.246</td>
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40
Panel B. Coefficient stability and selection bias from unobservables

<table>
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<th>Parameter</th>
<th>Panel B. Coefficient stability and selection bias from unobservables</th>
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<tr>
<td>Oster’s (2019) bound (β⁺, β)</td>
<td>[-1.253, -1.050] [-0.954, -0.941] [-0.795, -0.683] [-0.124, -0.104] [-0.003, 0.001]</td>
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<tr>
<td>Oster’s (2019) absolute δ for β = 0</td>
<td>19.51 4.60 206.28 3.37 0.835</td>
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<tr>
<td>Geographic/Agroclimatic controls</td>
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<tr>
<td>State fixed effects</td>
<td>Yes Yes Yes Yes Yes</td>
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Note: This table reports OLS estimates of the effect of TFE on collective climate action across American counties (Panel A). It also presents the results of the coefficient stability test developed by Oster (2019) (Panel B). The δ statistic reflects the importance of unobserved confounders, relative to observed control variables, in explaining away the main results. β⁺ is the bias-adjusted coefficient assuming that δ = 1 and R_max = 1.3R (R-squared of a hypothetical model incorporating observed and unobserved control variables is 30% higher than the R-squared value of the model with full observed controls). β⁺ would capture the effect of TFE on pro-climate action if one were to account for all unobserved confounders. An intercept, omitted for brevity, is included in all the regressions. Heteroscedasticity-robust standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.
<table>
<thead>
<tr>
<th>Collective climate action</th>
<th>CC_real</th>
<th>CC_human</th>
<th>Polsup</th>
<th>EQI</th>
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<td><strong>Panel B. First-stage estimates. Dependent variable: TFE</strong></td>
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<td>Pdmig</td>
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<td><strong>Panel C. Conley et al.’s (2012) bound estimates on TFE</strong></td>
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<tr>
<td>CI (2δ = 20%)</td>
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<td>[-1.714, -0.713]</td>
<td>[-1.267, -0.579]</td>
<td>[-0.080, 0.058]</td>
<td>[-0.022, -0.009]</td>
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<td>CI (2δ = 40%)</td>
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<td>[-1.362, -0.486]</td>
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<tr>
<td>CI (2δ = 60%)</td>
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<td>[-1.961, -0.470]</td>
<td>[-1.456, -0.394]</td>
<td>[-0.082, 0.060]</td>
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<td>CI (2δ = 80%)</td>
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<td>State fixed effects</td>
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<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
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<tr>
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<td>2,036</td>
<td>2,036</td>
<td>2,036</td>
<td>2,024</td>
</tr>
<tr>
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<td>607.21</td>
<td>607.21</td>
<td>607.21</td>
<td>604.48</td>
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<td>[-1.890, -1.043]</td>
<td>[-1.575, -0.850]</td>
<td>[-1.163, -0.681]</td>
<td>[-0.076, 0.054]</td>
<td>[-0.020, -0.011]</td>
</tr>
</tbody>
</table>

**Note:** This table reports IV-2SLS estimates of the effect of rugged individualism on collective climate action in the United States. CI (2δ = p%) reflects the 95% confidence interval of the coefficient on TFE when the direct effect of the instrument on collective climate action is assumed to be up to p% of the partial effect of TFE on the outcome variable in the baseline IV specifications. Heteroscedasticity-robust standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.
### Table 3

Rugged Individualism and Climate Change Attitudes at the Individual Level

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Believes in climate change and supports pro-climate action (CC_idv1)</th>
<th>Votes for imposing a cap on carbon emissions and funding research on renewable energy (CC_idv2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>TFE</td>
<td>-0.063*** (0.020)</td>
<td>-0.055*** (0.021)</td>
</tr>
<tr>
<td>Female</td>
<td>0.473*** (0.035)</td>
<td>0.477*** (0.035)</td>
</tr>
<tr>
<td>Age</td>
<td>-0.005*** (0.002)</td>
<td>-0.005*** (0.002)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>-0.088 (0.061)</td>
<td>-0.087 (0.061)</td>
</tr>
<tr>
<td>High school education or higher</td>
<td>-0.219 (0.148)</td>
<td>-0.220 (0.149)</td>
</tr>
<tr>
<td>Tertiary education or higher</td>
<td>-0.022 (0.147)</td>
<td>-0.022 (0.148)</td>
</tr>
<tr>
<td>Married</td>
<td>-0.299*** (0.037)</td>
<td>-0.295*** (0.037)</td>
</tr>
<tr>
<td>Single</td>
<td>-0.024 (0.061)</td>
<td>-0.020 (0.061)</td>
</tr>
<tr>
<td>Religiosity</td>
<td>-0.802*** (0.034)</td>
<td>-0.800*** (0.034)</td>
</tr>
<tr>
<td>White</td>
<td>0.243*** (0.086)</td>
<td>0.248*** (0.086)</td>
</tr>
<tr>
<td>Black</td>
<td>0.896*** (0.130)</td>
<td>0.906*** (0.131)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.454*** (0.118)</td>
<td>0.446*** (0.118)</td>
</tr>
<tr>
<td>Asian</td>
<td>0.828*** (0.270)</td>
<td>0.824*** (0.269)</td>
</tr>
<tr>
<td>Survey-wave fixed effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>State fixed effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Geographical/Agroclimatic controls</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Pseudo R-squared</td>
<td>0.118</td>
<td>0.119</td>
</tr>
<tr>
<td># of individuals</td>
<td>15,418</td>
<td>15,418</td>
</tr>
<tr>
<td># of counties</td>
<td>1,651</td>
<td>1,651</td>
</tr>
</tbody>
</table>

Note: This table presents probit estimates of the effect of TFE on individual-level pro-climate behaviors. Individual-level controls include socio-economic and demographic characteristics of survey participants. County-level controls include geographical/agroclimatic attributes and state fixed effects. Heteroscedasticity-robust standard errors, clustered at the county level, are reported in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.
Figure 1
The Partial Effect of TFE on Populism and Social Capital

*Note:* This figure depicts the effect of TFE on populism and social capital across American counties, conditional on several geographical/agroclimatic attributes and state fixed effects.

Figure 2
Partial Correlation between Individualism and CO₂ Emissions at the State Level

*Note:* This figure depicts the relationship between individualism and the intensity of energy-related CO₂ emissions in 2020 across American states, conditional on several geographical/agroclimatic attributes.

Figure 3
Partial Correlation between Individualism and CO₂ Emissions at the State Level (1970 – 2020)

*Note:* This figure depicts the relationship between individualism and CO₂ emissions measured for each year between 1970 and 2020 across American states. All the regressions are augmented with several geographic/agroclimatic attributes.

Figure 4
Partial Correlation between Individualism and CO₂ Emission Intensity at the Country Level

*Note:* This figure depicts the relationship between individualism and the intensity of CO₂ emissions across countries, controlling for several geographical/agroclimatic characteristics and unobserved (time-invariant) heterogeneity across world regions.
Notes

1 This study is closely related to Ang, Fredriksson, and Sharma (2020) postulating that self-reported measures of individualism are linked to a higher propensity to adopt of clean energy technologies among respondents of the Eurobarometer. By contrast, my findings are suggestive of the detrimental effect of individualism on collective climate action in the United States. I exploit a historically determined measure of individualism to explain the cross-county variation in pro-climate action. By contrast, Ang, Fredriksson, and Sharma (2020) employ self-reported individualism that is interrelated with and jointly determined by individual preferences for technology adoption.

2 Because of the complex, uncertain, and technical nature of climate knowledge, climate policy tends to be regarded as a reflection of the “mainstream” or the cosmopolitan elite, thereby hindering policy support in societies with pervasive populist attitudes (Morrison and Dunlap, 1986; Inglehart, 1995; Wets, 2019; Huber, 2020).

3 Frontier experience arguably hampers the emergence of social norms of reciprocal trust and cooperation because self-reliance was key to survival in frontier counties (Bazzi, Fiszbein, and Gebresilasse, 2020). This is in line with Turner’s (1893) argument that frontier settlers were less likely to be pro-social and that strong antipathy to restrictions on personal autonomy tended to emerge and persist in frontier counties. By contrast, Boatright (1941) is suggestive of pervasive unneighborly cooperation in frontier counties. However, Bazzi, Fiszbein, and Gebresilasse (2020) demonstrate that the development of extended reciprocity arrangements in frontier counties would have been difficult due to high levels of population mobility.

4 Geographical characteristics have been widely considered as the deep determinants of comparative development (see Spolaore and Wacziarg (2013) for a comprehensive literature review). They may affect long-run development through shaping institutions, productivity, and trade-related mechanisms.

5 Following the suggestion of an anonymous reviewer, I replicate the specification from Column (3) of Table 1 but control for CC_real. Accordingly, the coefficient on TFE remains negative and statistically significant at the 1% level. This reveals that TFE has a negative impact on public support for climate change policies holding the prevalence of climate change beliefs equal across American counties.

6 It is important to note that reverse causation is not a major concern in this context because contemporary climate change perceptions and responses are unlikely to have a direct influence on experience with the American westward-moving frontier between 1790 and 1890.

7 Just prior to the onset of frontier settlements, the westward-moving process of the American frontier was primarily driven by climate-induced emigration flows from Europe. According to Bazzi, Fiszbein, and Gebresilasse (2020), only less than 15% of American counties were exposed to frontier life for more than 3 decades, which justifies the choice of aggregating the national inflows of European immigrants over a period of 30 years commencing when a county was within 100 kilometers of the frontier line. However, Bazzi, Fiszbein, and Gebresilasse (2020) indicate that the role of TFE in shaping the prevalence of rugged individualism in the United States is quantitatively robust to using other periods.

8 Appendix Figure A2 illustrates the partial effect of Pdmig on TFE across American counties.

9 This line of reasoning is consistent with Bentzen (2019) who demonstrates that religiosity tends to prevail in societies with more frequent natural disasters. This is attributable to the role of unpredictable and unbearable life events in driving the formation of religious beliefs.

10 In particular, the IV-2SLS estimation can be implemented by removing $yPdmig$ from both sides of Equation [2].

11 See Vu (2023) for empirical evidence on the spatial diffusion of climate change policies across the world.

12 CCES is a nationally representative survey conducted every year to understand public attitudes toward elections (Schaffner and Ansolabehere, 2015).

13 This is consistent with Giuliano and Wacziarg’s (2020) argument that the popularity of Donald Trump in the 2016 Presidential election reflects increasingly prevalent populist attitudes in the United States.

14 This indicator is constructed using voting rates in Presidential elections between 2012 and 2016, response rates of the 2010 Census, and self-reported confidence in corporations, the media, and public schools.
The underlying intuition is that political participation captures individuals’ pro-social preferences and propensity to contribute to the provision of public goods (Dawes, Loewen, and Fowler, 2011; Bolsen, Ferraro, and Miranda, 2014).

Pre-treatment controls are key geographical/agroclimatic characteristics and state dummies that could simultaneously affect TFE and pro-climate action. These deep-rooted variables may provide alternative ‘fundamental’ explanations for cross-county differences in socio-economic development. Post-treatment intermediate confounders are factors affected by TFE that also have an influence on the dependent variable and the mediators. Hence, I consider all the ‘proximate’ causes of climate change perceptions and responses as post-treatment controls. These variables are included in Appendix Table A2.

Furthermore, Ogihara et al. (2015) establish that increasingly prevalent uniqueness and individualism are associated with a reduction in the rate of popular pronunciations of baby names in Japan between 2000 and 2013. More recently, Bazzi, Fiszbein, and Gebresilasse (2020) demonstrate that the variation in individualism across counties in the United States can be captured by the frequency of uncommon names and the absence of patronymic/matronymic names.

Data are obtained from the United States Energy Information Administration and State Energy Data System.

An alternative approach to measuring state-level individualism is to average frontier experience across numerous counties within a state. This provides data for up to 30 states. The results, available upon request, suggest that the averaged index of frontier experience at the state level is positively correlated with CO₂ emissions. However, the estimates are statistically insignificant possibly due to substantial reductions in the feasible sample size.

Data are taken from the World Bank’s World Development Indicators.

In line with previous studies in the long-run development literature, I do not control for the proximate causes of worldwide differences in environmental performance, such as economic growth or trade openness. This is because these proximate factors are interrelated with and jointly determined by the outcome variable. Furthermore, they can be affected by individualism. For this reason, incorporating the proximate determinants of CO₂ emissions in the regression analysis may provide biased and inconsistent estimates. When I control for the rate of economic growth, the coefficient on individualism turns out to be imprecisely estimated at conventional levels of statistical significance. However, these results, available upon request, do not necessarily carry causal inference due to the endogenous nature of economic growth.
Populism (Trump's vote share) Social capital index Voting turnout (2012-2020)

Point estimate (TFE) Confidence interval (95%)
CO2 emissions in 2020 vs. State-level individualism

coef = 4.281, (robust) se = 1.454, t = 2.94
Hofstede's country-level individualism

coef = 0.062, (robust) se = 0.029, t = 2.110