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RISING TEMPERATURES AND INEQUALITY: COLLECTIVE ACTION IN A CHANGING WORLD

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RISING TEMPERATURES AND INEQUALITY:

COLLECTIVE ACTION IN A CHANGING WORLD

BY

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CHAPTER 1: INTRODUCTION AND CONTEXT

In October, 2018, news outlets around the world became an echo chamber of damning headlines about the future of civilization. The newly released report by Intergovernmental Panel on Climate Change made clear that the clock was ticking and nearly everything we know is at stake. This "news" however, was preceded by nearly half a century of scientific consensus on the same conclusion:. The severe consequences global climate change poses to human life make failing to reduce greenhouse gas emissions rapidly an absurdly irrational collective choice. Yet shouting from the scientific community appears to have fallen on deaf ears, or at least a sea of political elites with their hands over theirs.

Decades of stifling and denying consensus of the scientific community, accompanied by several failed attempts at international treaties have made clear that the institutions designed to create order and foster cooperation in support of the general welfare are failing in doing so. Identifying the institutional barriers to collective mitigation of climate change is vital for both preventing the global humanitarian crisis unabated climate change is setting in motion and understanding governance and democracy in the twenty-first century. If states cannot overcome the collective action problem for the purpose of the preservation of humanity, understanding the root of the systematic failure of governance at all scales could be among the most important contributions of social sciences in history.

Despite being collectively rational, there are several confounding dynamics that account for the defection of individuals. First, the assumption that actors will behave rationally is dependent on their understanding of what is rational. Prior work has documented the concerted misinformation campaign designed to sow doubt and confusion about climate change, its causes,

and the timescale and magnitude of its consequences (Oreskes, 2011). Second, there exists a minority for whom mitigation is irrational at the individual scale (those to whom substantial benefits of the fossil fuel industry accrue and who have the economic capacity to isolate themselves from local adverse impacts of air pollution and climate change). Should this population be endowed with greater wealth relative to the majority, their interests will be even more disproportionately represented in the political sphere – both through direct influence and in manipulation of the information that other actors receive.

The study that follows explores the relationship between income inequality and cross-national variation in climate change mitigation. I conduct an ordinary least squares regression to determine the statistical significance of income inequality in predicting the extent to which a country has taken action to mitigate climate change and find a statistically significant relationship at very high levels of development.

CHAPTER 2: THEORY

Just three years before the IPCC report on the impacts of a 2 degree Celsius rise in temperature, the signing of the Paris Climate Agreement (PCA) made history as the first universal, legally binding international agreement on climate change – twenty years after the first Conference of Parties to the United Nations Framework Convention on Climate Change. Only two countries failed to ratify the agreement at the time of its passage – Nicaragua, which refused out of concern that the goals were not adequate for preventing perverse impacts, and Syria, which was in the midst of its fifth year of deadly civil conflict. In the years following both states did join the agreement. Then, on June 1, 2017, President Donald Trump made the announcement that he intended to withdraw the United States from the agreement:

> As President, I can put no other consideration before the wellbeing of American citizens. The Paris Climate Accord is simply the latest example of … leaving American workers — who I love — and taxpayers to absorb the cost in terms of lost jobs, lower wages, shuttered factories, and vastly diminished economic production. (White House Briefing, 2017)

One year later, the government-issued US National Climate Assessment predicted that climate change would cost the United States ten percent of its GDP by the end of the century should emissions continue business as usual. The Southeast alone would lose half a billion labor hours due to extreme heat. One trillion dollars of national wealth would be threatened by rising sea levels, flooding, and storm surges. By 2050, wildfires would ravage more than six times the forest area they historically have annually. Corn and soybean production would fall by at least twenty-five percent as a result of higher temperatures, drought, and flooding. An additional

2,000 people would die prematurely in the Midwest due to heat waves alone. The most vulnerable populations would face an increased risk of tropical diseases, asthma and allergies, and foodborne and waterborne illnesses. President Trump's rationale for withdrawing from the PCA from an economic standpoint is in stark contradiction to the findings of the country's climate change experts. (USGCRP, 2018)

Despite the United States' disproportional contribution of global emissions, the rest of the world has remained committed to the PCA. From a historical perspective, the defection of the United States from the agreement makes it just one of a long list of international cooperation mechanisms to reduce emissions in which the United States has failed to participate.

There is a stark difference between the United States and the rest of the developed world in terms of mitigation efforts as well as public opinion. In the European Union, where concern and acceptance of climate change is significantly higher among elites and the public than it is for American counterparts (Leiserowitz, 2007), "..the level of social and political acceptability across the EU … enables (indeed, forces) the EU Commission and national leaders to produce all sorts of measures, including taxes." (Schruers & Tiberghien, 2007:30). As the window in which policy action can be effective in ameliorating the vicious feedbacks of an accelerated carbon cycle, it is more important than ever to understand the mechanisms that have produced the divide between the United States and the rest of the developed world, as well as the factors that have enabled some countries to be more effective in reducing emissions than others.

As global carbon emissions have steadily increased, income inequality has grown across nearly all countries since 1980 (Alvaredo, et. al, 2018). As in the case of international climate negotiations, the divergence of the United States from Western Europe in terms of income inequality is particularly notable. In 1980, the top one percent income share was about ten

percent in both regions. In 2016, this had risen to 12 percent in Western Europe and 20 percent in the United States (Alvaredo, et. al, 2018).

As both temperatures and income inequality rises, it is becoming increasingly urgent to discern the possibility of a connection between the two.

Inequality as an Explanation for Inaction

The complexity of collective governance is that its outcome is not determined by a simplistic, objective summation of total costs and benefits, but rather is the product of competition between groups with opposing preferences and differential influence in the policymaking process. Environmentally degrading activities, including those that cause climate change, would not begin or persist without the existence of a group for whom the activity is a rational choice (Boyce, 1994). The "beneficiaries" that give cause for the degrading activity are those who profit from them to the extent that their individual benefits outweigh the potential risks climate change produces. Understanding the characteristics of this population and how its interests are represented in the political sphere are critical for explaining barriers to action.

First, the beneficiaries are winning; and they're better equipped to do so. Situations in which beneficiaries are powerful occur more often than those in which non-beneficiaries are powerful (Boyce, 1994). The reverse results in less degradation and is thus more easily corrected, which is not the empirical reality for climate change. The ability of these beneficiaries to achieve their desired individual outcome given its distance from the socially optimal, is a function of the beneficiaries' power relative to the nonbeneficiaries'. This could perceivably happen under one of three conditions: the nonbeneficiaries do not yet exist (as in the case of future generations), the nonbeneficiaries lack sufficient information to understand what is

happening, or the nonbeneficiaries lack the ability to respond (Boyce, 1994). While future generations will shoulder the brunt of policy decisions made today about climate change, we are seeing the effects of inaction now, and these effects will continue to worsen throughout the lifetime of the *current* population. Thus I will focus on the latter two conditions, both of which are created by economic inequality.

Because power reflects wealth and those who benefit from environmental degradation do so because they are profiting from it, beneficiaries are more often those with a greater income – that is to say, those who profit off of environmental destruction tend to be wealthy. Wealth gives weight to preference in the political sphere, whereby some groups are granted greater access in addition to being relatively better equipped to bare the transaction costs (Coase, 1960) of political influence. Therefore, the ability of beneficiaries to impose costs on nonbeneficiaries is a function of the beneficiaries' power - defined as ability to bare transaction costs (Boyce, 1994) - relative to the nonbeneficiaries'. Money speaks both in the market and in the "market" for political influence (Fergusson, 1983).

Preferences and Income

Traditional economic theory will dispute the notion that wealthy populations prefer degradation. As a superior good, demand for environmental protection increases with (and faster than) income (Scruggs, 1998). The theoretical underpinnings of this relationship for local environmental issues are clear; with wealth comes a higher standard of living and thus demand for environmental quality, as well as a lower likelihood that other issues (crime, economy, etc.) will force the environment out of a position of personal relevance. However, the relationship

breaks down under the complexities of global climate change, where negative effects are not entirely predictably or evenly distributed.

We can think about the costs of climate change as taking two forms: the air pollution driving climatic changes and the effects of those changes (extreme weather events, rising sea level, biodiversity loss, etc.). When it comes to air pollution, wealthy populations can often push the consequences of environmentally degrading activities on the poor while enjoying high environmental quality themselves (Roca, 2003). The ambiguities and uncertainties of model predictions also mean that a given individual cannot ascertain how they might be personally affected by climate change, which may create an irrational notion of invincibility that impedes any expected relationship across all income levels. However, regardless of uncertainty, wealthy people are less vulnerable to the effects of climate change. They are less susceptible to threats (vulnerability is geographically concentrated in areas of low socioeconomic status), and they have a have a much higher capacity for resiliency and adaptation (Adger, 1999; Adger, 2006; Brouwer, et. Al, 2007).

While not directly related to state-level policy outcomes, it is noteworthy that post-materialist values do not necessarily translate into changes in individual behavior (Berthe & Elie, 2015). Wealthier households have a much higher ecological footprint than poorer households (Mackenzie, Messinger, & Smith, 2008). Additionally, while those who benefit from environmentally degrading activity are likely to be wealthy, those occupying the top economic tiers do not, as a collective, benefit from degradation because not all wealthy people have ties to the fossil fuel industry. There exists substantial variation in preferences of the wealthy. Similarly, an increase in income inequality cannot be assumed to mean that only those who profit off of degradation earn a greater income. However, variation in preference among the wealthy is only a

threat to the theoretical underpinnings of the inequality-degradation hypothesis when all individuals at a given income level exert equal pressure for their preferred outcome. Given the low salience of climate change as a global issue and the high salience of personal profit, beneficiaries will be more willing to bare transaction costs, such that diversity of preference among the wealthy (as well as their desire to benefit from a healthy environment personally) is not relevant.

The reality at the opposite end of the spectrum is significant as well. Nonbeneficiaries of an environmentally degrading activity are often categorized as a nameless, unidentified group of people who each bear a small fraction of a broad externality. However, the effects of climate change are not distributed evenly across all those who do not directly benefit from the fossil fuel industry. Poor and marginalized groups are disproportionally impacted by pollution (Martinez-Alier, 2002) and climate change (Olsson et al, 2014). These discrepancies matter; the identity of nonbeneficiaries (and their corresponding relative power prior to the activity) will determine the outcome of the transaction (Boyce, 1994). That the wealthiest are protected the most from climate change and the poorest are the most vulnerable exacerbates the likelihood that economic inequality hinders action on climate change.

Collective Action and Inequality

Equality is an underlying theme in body of research on successful common property resource management. Ostrom (1990) concludes that the ability of individuals affected by operational rules to participate in the modification of those rules is a critical precondition for success of common property resource institutions. Inequality, which consistently leads to an unequal sharing of decision-making power (Neupane, 2003), directly undermines the potential

for this criterion to be met. Inequality also produces low levels of trust (Seabright, 1993) and an unequal allocation of benefits (Moore, 1993), both of which inhibit cooperation (Balant et al., 2007). Resentment and disincentives to contribute increase freeriding and thus produce unsustainable outcomes (Anderrson & Agrawal, 2011). Additionally, inequality hinders the legitimacy of a common purpose and shared norms which Ostrom also identifies as necessary preconditions (p. 205-207). Economic inequality both undermines the likelihood that collective organizing will ever be initiated (Mukhopadhyay, 2004) and that it will be sustained (Andersson & Agrawal, 2011). Overall, empirical evidence supports that inequality is likely to lead to worse environmental outcomes in the case of common property resources.

Inequality and Environmental Outcomes

Preliminary cross-national evidence has supported the relationship between inequality and environmental outcomes across multiple dependent variables. Economic inequality is positively related to biodiversity loss (Mikkelson, Gonzalez, & Peterson, 2007; Holland, Person, & Gonzalez, 2009). In developed countries (where protected areas do not themselves cause equity issues), equality and democracy are associated with more area of protected land (Kashwan, 2016).

Thus far, there have been no systematic studies on state-level inequality and domestic climate change mitigation. However, cross-national ecological footprint comparisons have suggested that this relationship will hold. Despite having similar GDP's, the average per capita footprint in Japan, far more equitable than the US, is about half that of the US (Islam, 2015).

Hypothesis

I predict that the environmental "inequality hypothesis" as theorized by Boyce will be corroborated in cross-national climate change politics. Income inequality has morphed the political landscape to undermines the principles of democracy that would otherwise take action to mitigate climate change. By giving disproportionate influence to those who rationally prefer environmental degradation, income inequality should shift the preferences of both the elite and the public away from mitigation.

When income inequality is high, the beneficiaries of climate change will have an even greater propensity to affect policy outcomes, while the rest of the population has less capacity to push back. With even greater wealth, the beneficiaries can make larger campaign contributions to politicians who will vote against climate change policies and have a greater capacity to run for office themselves. At the same time, the dispersion of less wealth among the rest of the public will reduce the potential of those who support action to win public office. However, the influence of the beneficiaries extends beyond directly "buying" votes.

In a democracy, we should expect to see action on climate change when the level of public support would make irrelevant politicians bowing to fossil fuel interests. Thus, the influence of income inequality in shaping public opinion is of just as much significance as the direct effect of money in elections and voting decisions. There are many factors that conceivably play a role in an individual's preference on climate change, including their understanding of the associated risks and their perception of personal vulnerability. The reality of the issue as highly technocratic that informational cues by elites and the media will have more weight in the formation of opinions by the general public (Wood and Vedlitz, 2007; Soroka, 2002). The

beneficiaries thus have incredible power to tip support in their favor through the manipulation of information.

For example, evidence has clearly demonstrated that, particularly in the United States – the major outlier among advanced democracies on climate action – a massive misinformation campaign funded by corporate interests has increased partisanship on the issue by convincing the public that climate change is not real, will not affect them, is not caused by humans, or that preventing it will be economically disadvantageous (Oreskes, 2011). Through cross-national comparisons of climate policy and commitments, the effect of income inequality should be clear.

I hypothesize that among advanced democracies, states with higher levels of income inequality will have achieved less action on climate change. If my hypothesis is correct, I should find that income inequality is a significant, negative correlate with domestic emissions reduction.

CHAPTER 3: DATA AND METHODS

The purpose of this paper is to compare the level of income inequality within a country to the level of action that the respective country has taken to mitigate global climate change. To this aim, I performed an ordinary least square (OLS) regression of indices of income inequality on indicators of mitigating action for two subsets of 86 total countries, controlling for regime type, level of development, and membership in the European Union (Table 1). All measures were calculated with data from 1992 (when that the United Nation's Framework Convention on Climate Change was adopted) and 2014 (the most recent year with emissions data available).

Countries were selected and subset into two groups according to the assumptions of the theoretical mechanism between the independent and dependent variable: 1) the ability of citizens to impact political decisions related to the environment, and 2) the distribution of preferences such that the those who benefit from inaction tend to be very wealthy. These assumptions require democratic institutions and a high level of development. Only countries that met the minimum threshold for classification as a democracy (a score of 6 or higher on the Polity IV Index) in at least half of the years between 1992 and 2014 were included for analysis. The presence of free and fair elections, even if irregular or problematic, imply that political elites must be somewhat responsive toward the preferences of the citizenry. From this list, countries that were not independent states in all the years over the relevant time frame were excluded owing to their lack of sufficient data and underdeveloped independent political institutions.

Table 1 *Variables, sources, and predicted relationships*

Variable	Indicator	Source	**Hypothesized Relationship** (under democracy and very high development)
Action to mitigate Climate Change	Percent change in per capita carbon dioxide emissions	Carbon Dioxide Information Analysis Center (CDIAC)	*N/A:* Dependent Variable
	Change in percent of energy consumption from fossil fuels	World Bank	
Income Inequality	Gini coefficient	World Bank	*Negative* Higher inequality will result in a more skewed distribution of benefits of the fossil fuel industry, where the wealthy benefit more accruing to the wealthy + wealthy having relatively more political influence
	Palma Ratio	United Nations Development Programme (UNDP)	
	Income share of the top 10%	UNDP	
Vulnerability to climate change	Exposure Index	Notre Dame	*Positive* When the costs of climate change are greater in magnitude, there will be a larger or stronger coalition pushing for action on climate change. It will affect more people and/or be more salient
Resource endowment	Total coal production	US Energy Information Administration (EIA)	*Negative* When the economic benefits of the fossil fuel industry are greater, there will be a larger or stronger coalition pushing for action on climate change. More people will profit, and/or powerful individuals will profit more
	Total petroleum production	US EIA	
Dummy: External pressure	Membership in the European Union	Historical records	*Positive* The coercive emissions reduction required by EU membership should result in its members taking more action than their counterparts
Blocking factor: Development	Blocking factor: Development Classification	World Bank	*Positive* At high levels of development, only the very wealthy tend to be beneficiaries of the fossil fuel industry. This is not true at lower levels of development.

As discussed in the Theory section, the second assumption is currently only met in advanced, industrialized economies, where the poor and marginalized do not receive significant benefits from fossil fuel consumption. To test the merits of this theory, I divide the included countries (n=86) into those that are very highly developed (n=39) and those at high, medium, and low development (n=46), according to the classification scheme of the United Nations. Each of the models are run for both groups.

The complexity of interests and exogenous factors that impact policymaking produce a plethora of potentially confounding factors. I tested for several of these potential confounders: vulnerability to the effects of climate change, the scale of fossil fuel production within state boundaries, and membership in the European Union. Of these variables, only membership in the European Union was significantly related to emission levels and included in further analyses (Appendix 1).

Action on Climate Change

With no global index of country-level climate change mitigation, prior work comparing the political outcomes on climate change in countries around the world have tended to do so through case studies and survey data. The traditional mechanism for assessing willingness to contribute to international collective action dilemmas – ratification of international treaties and participation in transnational governance institutions – has little empirical in the context of international climate change politics. Ubiquitous membership in the principal transnational institution for climate change governance, the United Nations Framework Convention on Climate Change (UNFCC), results in limited variation from dichotomous measures of participation. While the historic trajectory of Conferences of Parties (COPs) to the UNFCC have

varied along dimensions of success and support among parties, the ineffectiveness of the institution to produce binding targets for signatories (with the Paris Climate Agreement a landmark exception – which, again, has almost no variation in ratification) makes this information suitable for analyzing cues of political elites, but inconsequential for understanding variation in realized outcomes. Furthermore, assessing legislative and executive action at the domestic level may provide information about political will for change, but it is irrelevant without effective implementation and is complicated by the difficulty of assessing different time scales and potential for reducing emissions. Thus, I coded two measures to capture the substantive effectiveness of a given country in mitigating global climate change: changes in carbon dioxide emissions and changes in fossil fuel consumption.

As the predominant driver of global climate change per capita levels of carbon dioxide emissions are the most robust indicator of a country's contribution to climate change. With sufficient political will to engage in mitigation, a country will create standards, regulations, incentives, and investments to reduce its "carbon footprint." Thus, the trajectory of change of carbon dioxide emissions within a country tells the abridged story of climate change politics. The primary dependent variable I use as an indicator of action on climate change is reduction in emissions over the time frame of this study: 1992 (when the UNFCC was adopted) to 2014 (the most recent year with data available). I calculated a single score for each country by taking the opposite of the percent change in total carbon dioxide emissions from 1992 to 2014 (such that higher numbers indicate greater reduction in emissions and lower numbers indicate less reduction or an increase in emissions in the case of negative numbers).

For robusticity, I also calculated the change in percent of energy consumption from fossil fuels as a second measure of action on climate change.

Inequality

There are many indices of income inequality, each with different implications for (. Though all of the measures I considered (Appendix 2) are highly correlated with each other measure, only a small subset have high theoretical relevance in the context of my theory: income share (percent) of the top ten percent (World Bank), the Gini coefficient (a statistical measure of dispersion with 0 corresponding to complete equality and 1 corresponding to complete inequality), and the Palma Ratio (ratio of the income share of the top ten percent compared to the bottom forty). Because the temporal impact of inequality (that is, when a shift in inequality will produce an observable change in the dependent variable) has not been established, I create a pseudo constant by taking the average annual score of each indicator over the time period included in this analysis (1992-2014). Inequality was relatively stable for most of the countries over this time frame, with very marginal shifts over time.

Table 2 *Summary Statistics*

Variable	Count	Mean	Standard Deviation	Minimum	Maximum
Median Polity Score (92-14)	86	8.42			
Average Gini Index: 92-14	82	39.93	9.53	25.27	62.15
Average Gini Index: 10-17	80	38.28	8.72	25.00	63.00
Palma Ratio: average 10-17	80	1.95	1.14	0.90	7.00
Inequality in income: avg 10-17	80	23.20	9.21	6.30	56.40
Share of top 10%: avg 90-14	72	30.70	7.99	1.68	51.30
Total CO2 Emissions: %Change 92-14	81	77.44	116.12	-64.00	603.00
Per Capita CO2 Emissions: %Change 92-14	81	30.89	66.31	-58.60	300.00
% Electricity from FF: %Change 92-14	76	16.57	101.88	-54.40	834.00
Vulnerability Index: Avg(95-15)	86	0.42	0.07	0.27	0.63
Coal Production	86	2.03	2.06	0	6.03
Petroleum Production	86	1.23	1.18	-0.24	3.98
EU Membership	86	0.32	0.47	0	1.00

Analysis

The base model *(1)* fits reduction in emissions as a linear function of the Gini coefficient, controlling for a dummy variable indicating membership in the European Union, and a randomly distributed error term:

$$-(\%\ change\ in\ per\ capita\ emissions) =$$

$$\beta_0 + \beta_1 * (Gini\ Coefficient) + \beta_2 * (EU\ membership\ dummy) + \varepsilon,$$

$$\varepsilon \sim N(0, \sigma^2)$$

Subsequent models replaced the Gini Coefficient with other indicators of inequality: Palma ratio (*2*), income share of top ten percent (*3*).

Models *4*, *5*, and *6* fit the same function as a prediction of change in emissions from fossil fuels.

$$-(change\ in\ \%\ of\ energy\ from\ fossil\ fuels) =$$

$$\beta_0 + \beta_1 * (Gini\ Coefficient) + \beta_2 * (EU\ membership\ dummy) + \varepsilon,$$

$$\varepsilon \sim N(0, \sigma^2)$$

Models 7-12 conduct the same regressions for all lower levels of development. For these analyses, the EU membership dummy is dropped from the model because there does not exist an EU member at a lower level of development than “very highly developed”.

CHAPTER 4: RESULTS

The results of the OLS regressions substantiate my hypothesis that higher levels of inequality are correlated with less reduction in per capita emissions in very highly developed countries. However, inequality is not significant in predicting change in percent of energy from fossil fuels.

The results of Models 1-3, which regress inequality on reduction in per capita emissions, are displayed in Table 3. All indicators of inequality are significant at the 0.05 level. Income share of the top ten percent is the most statistically relevant among these, as the only indicator significant at the highest level (0.001) when controlling for membership in the European Union. Membership in the EU is statistically significant across all indicators of inequality and significantly improves the R squared value of all models when included.

Table 3 Regression Results Models 1-3

Group: Very High Development; DV: Reduction in Per Capita Emissions

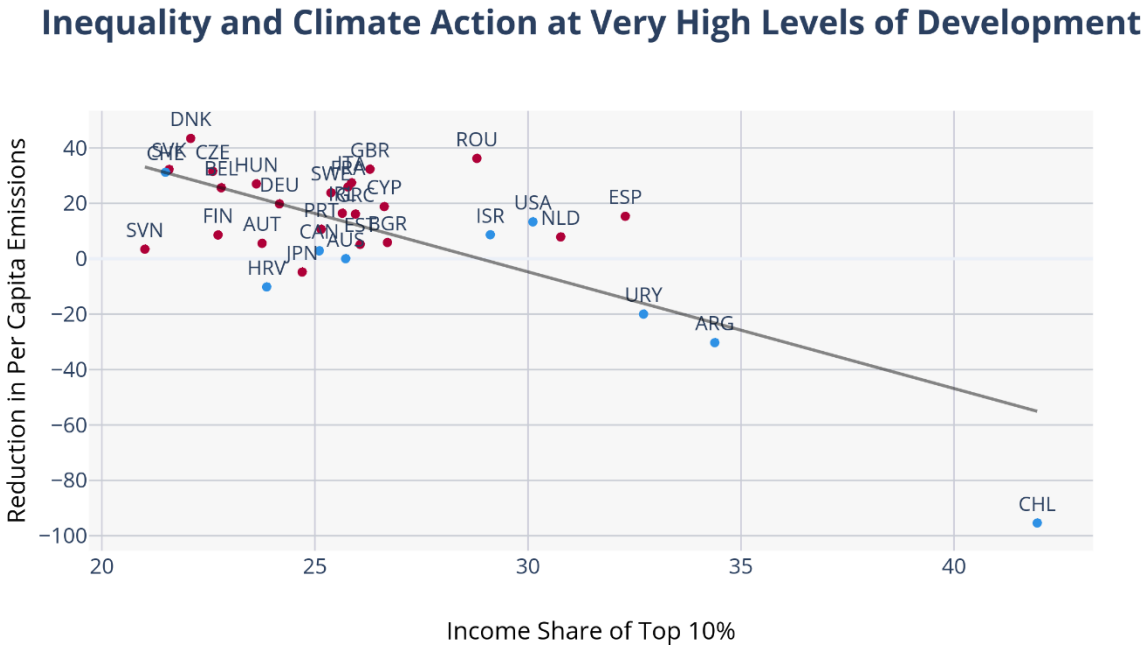
	1		*2*		*3*	
Constant	92.9261***	43.831	59.127***	21.861	121.6108***	92.3687***
	(22.1095)	(25.134)	(13.021)	(16.672)	(19.1619)	(22.7614)
Gini	-2.4549***	-1.555*				
	(0.6503)	(0.646)				
Palma			-35.729***	-22.160*		
			(9.265)	(9.356)		
Income Share of Top 10%					-4.2114***	-3.5214***
					(0.7163)	(0.7515)
EU Membership		26.242**		25.991**		15.3448*
		(8.351)		(8.322)		(7.2219)
Adjusted R-Squared	0.2746	0.4248	0.2781	0.4226	0.5199	0.5702

Significance: * P < 0.05, **P < 0.01, *** P < 0.001

Model 3 is the most robust model I designed. The results show that increasing the income share of high earners by ten percent, controlling for membership in the EU, makes the country's emissions reduction 35 percent smaller than the reduction of other countries. Irrespective of inequality, however, countries that are a member of the EU have systematically reduced emissions by more (about 15 percent) than nonmembers. Figure 1 illustrates the observed relationship between income share and reduction in emissions, disaggregated by EU membership.

Figure 1 Relationship Between Inequality and Emissions Reduction at Very High Development (Model 3)

****Red dots indicate membership in the EU; blue indicates nonmembers****



Data Sources (Table 1): Emissions data | Carbon Dioxide Information Analysis Center
Income share data | World Bank

Models 4-6, which test the correlation between inequality and reduction in energy from fossil fuels significantly at very high levels of development, yields very different results for the relationship between the two (Table 4). Income share of the top ten percent is the only statistically significant indicator in predicting reduction in energy from fossil fuels, and it is only significant when EU membership is not included in the model. EU membership is not significant in any of the models with reduction in energy from fossil fuels as the dependent variable.

Table 4 Regression Results Models 4-6

Group: Very High Development; DV: Reduction in energy from fossil fuels

	4		*5*		*6*	
Constant	19.2883*	8.0366	16.178***	8.538	24.7861**	17.1529
	(7.7310)	(9.5091)	(4.470)	(6.229)	(7.7471)	(9.6110)
Gini	-0.3396	-0.1334				
	(0.2274)	(0.2444)				
Palma			-6.129	-3.347		
			(3.181)	(3.496)		
Income Share of Top 10%					-0.6194*	-0.4393
					(0.2896)	(0.3173)
EU Membership		6.0142		5.328		4.0055
		(3.1594)		(3.109)		(3.0495)
Adjusted R-Squared	0.03396	0.1032	0.07007	0.1188	0.1034	0.1245

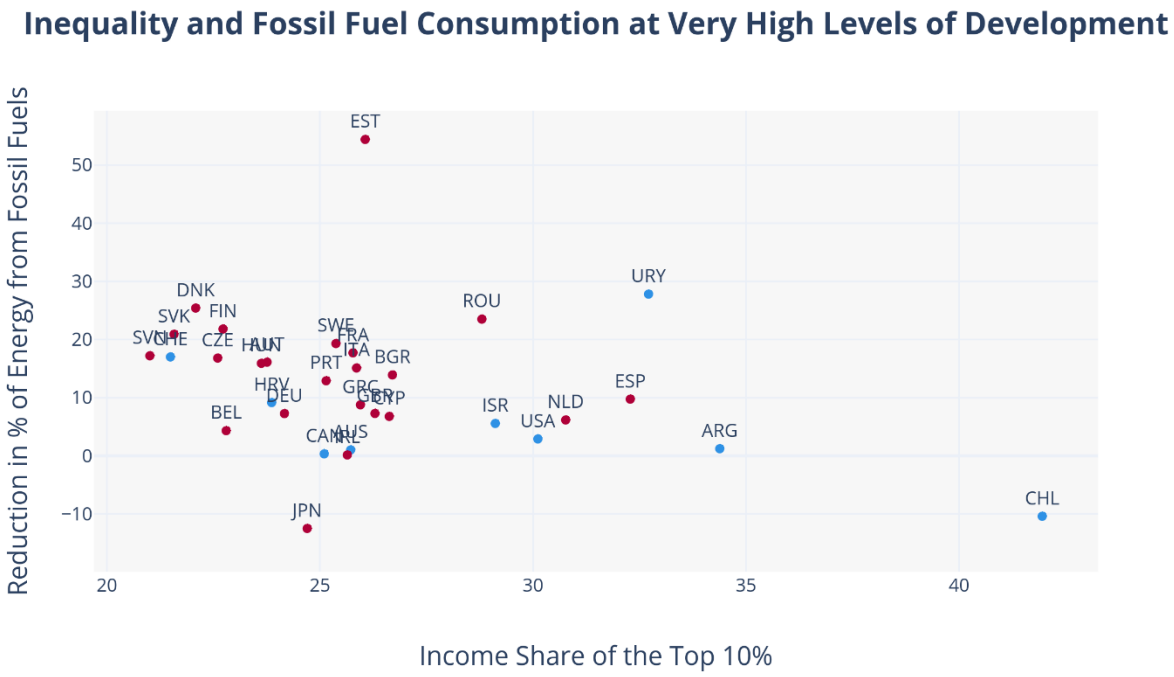
Significance: * P < 0.05, **P < 0.01, *** P < 0.001

Despite the divergence between the models on the significance of the independent variable, the two dependent variables are strongly correlated with each other. The correlation coefficient (across all levels of development) between reduction in per capita emissions and change in percent of energy consumed from fossil fuels is 0.80 (Appendix 2), which indicates that the variables are measuring similar constructs, but the differences in their operationalization

are substantial enough to yield different regression results (Figure 1 vs. Figure 2). Possible explanations for this discrepancy are discussed in the following section.

Figure 2 Relationship Between Inequality and Reduction in Fossil Fuel Consumption at Very High Development (Model 6)

****Red dots indicate membership in the EU; blue indicates nonmembers****



Data Sources (Table 1): Fossil Fuel Consumption | World Bank
Income share data | World Bank

Models 7-12 (Table 5), which run the above regressions for countries at high, medium, and low development support my hypothesis that the negative relationship between inequality and action on climate change is only present at very high levels of development. No measure of income inequality is significant in predicting either dependent variable at the lower three levels of development. The coefficients in these models are positive, suggesting that there is a slight

positive trend between inequality and climate action, but the variation explained in these models is remarkably low – essentially zero.

Table 5 Regression Results Models 7-12

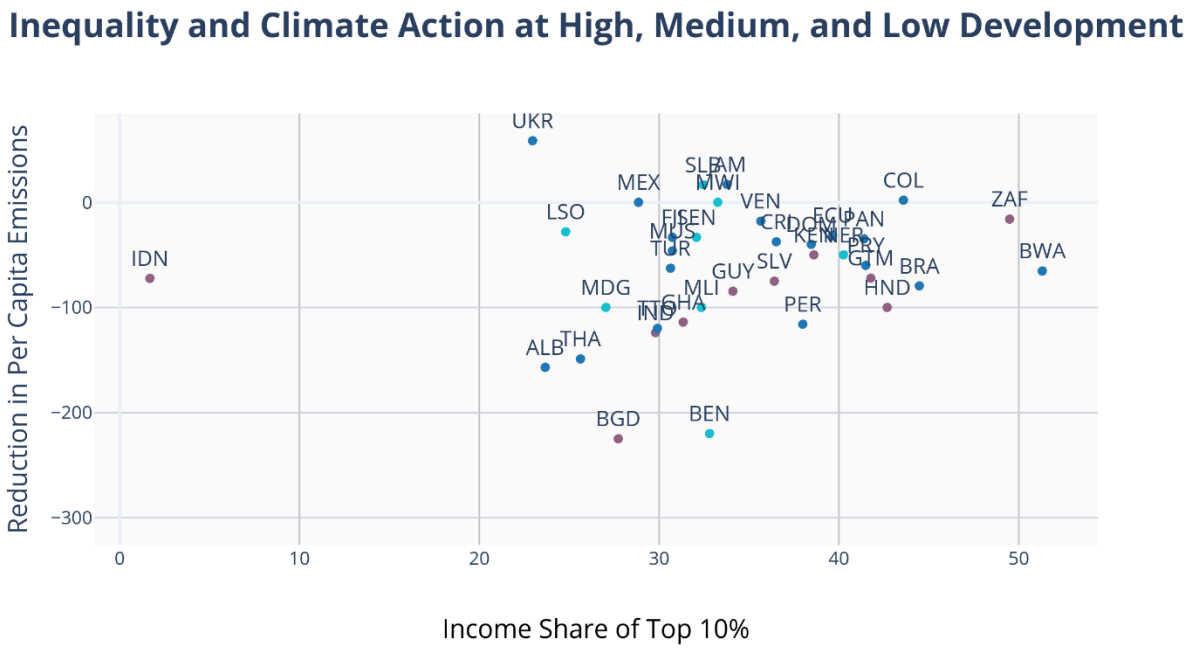
Group: Lower levels of development
Model 7-9: DV = Reduction in per capita emissions
Model 10-12: DV = Reduction in energy from fossil fuels

	7	*10*	*8*	*11*	*9*	*12*
Constant	-159.964**	-8.70492	-92.369***	-6.5228	-102.935*	-3.71879
	(55.254)	(14.31573)	(23.816)	(6.1296)	(40.904)	(12.67412)
Gini	1.976	0.07703				
	(1.200)	(0.31157)				
Palma			8.704	0.2756		
			(8.358)	(2.2034)		
Income Share of Top 10%					1.105	-0.04717
					(1.168)	(0.36031)
Adjusted R-Squared	0.04108	-0.0218	0.002221	-0.024	-0.00292	-0.02585

Significance: * P < 0.05, **P < 0.01, *** P < 0.001

Figure 3 Relationship Between Inequality and Reduction in Emissions at Very High, Medium, and Low Development (Model 9)

****Blue dots indicate high development; purple - medium; teal - low****



Data Sources (Table 1): Per Capita Emissions | Carbon Dioxide Information Analysis Center
Income share data | World Bank

CHAPTER 5: DISCUSSION

The above results indicate that the inequality hypothesis of environmental degradation is a useful framework for understanding variation in action to mitigate global climate change. Though the observed correlation does not prove causation, nor the assumptions of the above argument, the statistical and empirical significance of inequality in predicting reduction in emissions at very high levels of development demonstrates that income inequality plays a role in the social-political context of climate change.

Despite the finding of significance, however, the data also suggest that the relationship between these constructs is more complex than can be modeled by a simple linear regression. Two major sources of variability between the models carry important implications for the underlying theory: the distribution of R squared values that result from different indicators of inequality and the opposing significance results produced from the two dependent variables.

The variation in the adjusted R squared values between each of the models provides insight into the specific pattern of wealth distribution that most accurately models how wealth mediates preferences and political outcomes. The strongest predictor of emissions reduction, income share of the top ten percent, suggests that the preferences of high-income earners (specifically the top ten percent) have the largest impact on observed political outcomes. The lower adjusted R squared values of indicators that quantify distribution across all levels of income (Gini and Palma) implies that distribution to lower deciles is not as relevant as the amount of wealth that accrues to elites. The conclusion that can thus be drawn is that the enhanced interest and capacity to bare political transaction costs (both driven by higher profits) of the beneficiaries of climate change is more important for determining the resulting outcomes

than the lower capacity of nonbeneficiaries to respond. The preferences and power of elites matter substantially for state-level outcomes on climate change.

The second major source of variation is the opposing conclusions that can be drawn about the relevance of inequality from different indicators of action on climate change. Rather than function as a robusticity check, models using the change in percent of energy from fossil fuels as the dependent variable resulted in inequality having no significance. The major differences between this variable and reduction in per capita emissions is the set of actions that can be captured by each. In order to reduce their contribution to climate change, a country can reduce its reliance on fossil fuels, replacing them instead with renewable energy sources, or it can reduce the amount of energy that it is consuming in the first place through more efficient appliances and infrastructure (along with other actions that are not captured in either variable as discussed below). The reduction in per capita emissions reflects efforts that fall under both of these categories, while fossil fuel consumption only reflects the former.

The difference of significance of both membership in the EU and inequality suggest that these variables have an impact on some political decisions, but not others. More specifically, inequality – which has been theorized as the magnitude of benefits obtained from the fossil fuel industry to elites – matters for preventing general reduction in emissions, but it is not successful in preventing reduction in the percent of energy consumed from fossil fuels. This is likely because the falling price of renewable energy gives it the economic momentum to replace fossil fuels, irrespective of politics.

Another key finding from this analysis is that international institutional pressures shape domestic decisions in significant ways. The cap and trade program of the EU, as well as other standards and expectations created through the organization, have been effective in reducing

emissions, such that nonmember countries are systematically falling behind members in mitigation. Future efforts to combat climate change should thus utilize the framework adopted by the EU, especially future revisions to the Paris Climate Accord. A greater emphasis on and more ambitious targets set by binding international agreements and cross-national programs may help to combat the social-political barriers to action at the domestic level, as well as accelerate action to the rate that is now necessary to prevent catastrophic repercussions of climate change.

The forty percent of variation not explained by the most robust model (Model 3) means that, as expected, state-level variables other than inequality and EU membership matter. These variables may not be quantifiable in a cross-national analysis through basic, ubiquitous measures.

Significance

The substantiation of the inequality-degradation hypothesis for climate change politics implies that the amount of action a country takes to combat climate change is determined to a large extent by the distribution of costs and benefits of the issue. Actions that alter the cost-benefit equation of action/inaction could therefore fundamentally shift political outcomes in the direction of more mitigation. For example, increasing the operational costs or decreasing the economic benefits of the fossil fuel industry (through carbon taxes, cap and trade programs, for example) could substantially lower the probability that fossil fuel interests will successfully determine policy outcomes.

Alternatively, efforts to strengthen collective action among nonbeneficiaries or the relative significance of their actions could have the same effect of increasing mitigation at the state level. Institutions that enhance the role of wealth in the political sphere by giving greater advantage to elites (such as Citizens United in the United States) allow inequality to have a

substantial effect on policy. Thus the future of democracy and climate action are dependent on the fate of institutional arrangements that define the political power of wealth.

These findings matter for common pool resource, collective action, and rational choice theory. The results indicate that Ostrom's (1990) principles for managing nonexcludable, exhaustible resources in a localized context extrapolate to international scales as well. Furthermore, models approximating preferences and political outcomes should not underestimate the power differentials that both shape preferences (sometimes irrationally – the effect of elite cues in cultivating irrational preferences of the general public) and the relative weight that each preference is assigned. Given the power of elites in shaping political outcomes, the decision to engage in collective action is not merely a reflection of the salience of an issue to the individual, but a calculation of forces that tilt the playing board either against or toward that individual's interests. The perceived and actual political efficacy of an individual are likely shaped by inequality.

The fact that inequality is functioning as a barrier to political deliberation that coalesces on the rational choice for the majority also has important ties to literature on democratic backsliding. Any factor that obstructs democracy, particularly well-established, very highly developed democracies, should be understood as a global threat to political stability. The disproportional impact that the beneficiaries of the fossil fuel industry have on environmental outcomes is a signal that the basic foundation of democracy – that the majority rules – is not an empirical reality in even the most well-established democracies. The growth of inequality globally, in the context of the above findings, legitimizes the fear that democracy may be in decline.

Limitations and Suggestions for Future Research

While the results of this analysis suggest correlation between inequality and action to mitigate climate change as predicted by the theory I set forth, additional research is needed to establish the mechanism between the two variables. The proposed explanatory theory for the relationship observed makes several key assumptions that have not been supported with empirical data, including the preferences and importance of those preferences to individuals – particularly as it relates to wealth, the collective action that individuals choose to engage in to effect policy, and the disproportionate impact that wealthier people have in politics (which will vary by country).

Our current understanding of the competition of interests related to climate change, as well as its construction and perception among the public, is largely anecdotal. There are few systematic studies of cross-national differences in the interest campaigns advocating for more regulation to reduce emissions and fossil fuel consumption and that advocating for less. Future research should explore the dynamics of public opinion, education, and media within the context of inequality. That is, does a country with high levels of inequality take less action because the beneficiaries of climate change have more political influence? Because they succeed in massive misinformation campaigns (executed in the media and academic sphere) that confuse a public that is also more vulnerable to such factors, resulting in climate change being a lower priority for the citizenry as a whole? Do the beneficiaries exert their influence through some combination of the above?

Smaller scale, contextualized analysis would also be useful in exploring how social-political dynamics play out in real life – particularly whether citizens are aware of an unlevel playing field and how it effects their disposition toward the issue. In countries with high levels of

inequality, are the non-beneficiaries actively engaged in organizing for action on climate change but nevertheless "losing", or are they less engaged than their counterparts in countries with lower levels of inequality, acting rationally with the information that their preferences will be ignored? Further research is needed to identify mitigating factors (such as campaign contributions, political rights and liberties, entrenched norms of the mainstream media, etc.) in the influence of inequality on policy, as well as the relative weight of these factors in comparison to inequality. This type of information will reveal what interventions (aside from reducing inequality, which is entrenched might be effective in shifting climate policy.

In addition to the need to establish the mechanism behind the observed correlation, this analysis exemplifies the need for an index of action on climate change. More specifically, an index that incorporates and disaggregates between successful mitigation, action committed to that will produce observable changes in the future, and goals set by legitimate political authority is necessary for comprehensive analysis of domestic climate change politics. This need is substantiated by the opposite conclusions that can be drawn from the two indicators used in this analysis, and by an inability to assess variation in the most landmark piece of legislation on climate change – the Paris Climate Agreement. The theory and methodology of this paper should be adapted to test the inequality theory through different operationalizations of the dependent variable, particularly the outcomes of the Paris Climate Agreement – both in the goals committed to (though this is also a test of conformity and cues by political elites to international actors) and effectiveness in achieving those goals.

The operationalization of the dependent variable (action taken to mitigate climate change) limited in analysis to only a subset of potential variation in action. Observable changes (in per capita emissions and energy from fossil fuels) are limited by their temporal nature in

ways that could be particularly problematic for an issue like climate change (which requires system-changing solutions with operational time scale of decades). These measures do not capture action that a country has taken that has yet to produce observable results, nor action that a country has committed to taking in the future. These policies and goals matter empirically; countries with long-term plans to substantially reduce emissions should not be considered to contributing less than countries that have successfully achieved short-term, but unsustainable payoffs in reductions. In the context of international climate change politics, it is notable that these measures exclude variation in Nationally Determined Contributions of the Paris Climate Agreement.

Aside from the temporal dimension, the dependent variable also does not capture actions that help to mitigate climate change that do not result in less emissions or fossil fuels consumed. Not all actions that mitigate climate change occur through these pathways. For example, policies that increase sequestration of carbon dioxide (such as programs designed to increase forest cover or agricultural incentives to adopt practices that retain carbon in the soil) can have a substantial impact in reducing carbon dioxide in the atmosphere. However, these actions are not measured in the calculation of a country's carbon dioxide or fossil fuel footprint. Similarly, scope three emissions (emissions that occur outside of the boundary of the country that occur as a result of action within the country's boundaries) matter empirically, but are not included in this analysis.

A more exhaustive operationalization of the dependent variable would produce a more accurate representation of the action a country has taken to mitigate climate change. However, it should be noted that the bounds of the operationalization used in this analysis does not necessarily translate into limitations of the results. In regard to the temporal restriction, a relationship between inequality and emissions (if present) should be apparent in the country's

preliminary response to the scientific consensus around climate change that was present at the onset of the included data. That the included data occurs before the Paris Climate Agreement may actually be a strength of the analysis because it somewhat controls for the effect of political elites responding to international pressures as opposed to domestic. Similarly, some actions that are relevant to mitigation may not be relevant for domestic politics. Decisions by individual actors to buy or sell local products (reducing scope three emissions) may stem from cultural factors rather than state-level coercion, which would confound the observed relationship between state action and inequality if included.

Nevertheless, variation in the predictive power of inequality on different indicators of action should be explored as another source of evidence toward the mechanism of the theory and its implications for the future of collective action on climate change. Correlation between some approaches to mitigation and not others could suggest that the difference in preferences between those with power and those without is only activated or applicable for certain policies. This variation could reveal the motivations of the beneficiaries of inaction and thus opportunities for negotiation, as well as decarbonization pathways most resilient to the political tactics and interests of the beneficiaries.

CHAPTER 6: CONCLUSION

Climate change is a basic common pool resource problem. One country's decision to prioritize long-term human well-being will only be effective should each other country make the same decision. The aggregation of state-level decisions is inherently complicated by the diverse economic pressures, social relationships, and cultural values that shape individual preferences and the institutions through which these interests are negotiated. Understanding the failure of the international community to respond to this issue with the urgency necessary for preventing crisis thus requires examining domestic factors

Borrowing from Boyce's (1994) inequality-environmental degradation hypothesis, I tested and found support for my hypothesis that state-level income inequality negatively impacts state-level decisions to contribute to mitigating global climate change for advanced democracies. The reality of the economic structure of the energy sector and institutionalized environmental racism is such that the benefits of inaction on climate change accrue disproportionately to the very wealthy, while the poor and marginalized bare the largest burden from the costs of the causes and effects of climate change. Previous literature on the transaction costs of political influence posits that the political influence that an individual is granted is a function of the income that individual receives.

The results lend credence to this theory in that the relative wealth of elites significantly predicts the degree of action a country takes to mitigate climate change. In particular, the income share of the top ten percent is strongly, negatively correlated with lower emissions reduction in countries that are democratic and very highly developed.

The results of this analysis are not conclusive, but rather lay the foundation for future theory and research related to collective action and climate change politics. Inequality plays an important role in warping the negotiation of preferences in favor of the very wealthy. The correlation between irrational outcomes on climate change and high levels of inequality has major implications for the future of collective action, as well as domestic politics. Most importantly, income inequality is a powerful threat to global democracy and stability more generally through its role in eroding democratic institutions and in functioning as a barrier to rational action on one of the most critical issues humanity faces: global climate change.

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APPENDIX

Appendix 1: Insignificant Control Variables

First, I used Notre Dame's Global Adaptation Initiative's (ND-GAIN) Exposure Index to test for the effect of a country's vulnerability to climate change on the extent of action that they take. This index captures the propensity of the supporting sectors of a society to be impacted by hazards produced by climate change. The Exposure Index codes the magnitude of stress likely impact food, water, health, ecosystem services, human habitat, and infrastructure. Exposure, irrespective of vulnerability resulting from the resiliency of the systems at risk, is slightly negatively correlated with GDP per capita. However, when controlling for development, exposure to climate risk has no significant impact on reduction in emissions and is thus excluded from the models tested.

I also tested the effect of the size of the fossil fuel industry in the country. Holding inequality constant, I expected the magnitude of the political pressure expressed by those who benefit from inaction on climate change to increase with the size of the industry, such that countries with a larger resource endowment do less about climate change. Controlling for the average tons of primary coal produced annually over the years included in this analysis, I find no relationship between coal production and emissions. Similarly, I find no relationship between petroleum production and emissions. There is a problem of endogeneity with these variables

Appendix 2: Comparison of Inequality Measures

Table 6 *Indicators of Inequality*

Variable	Description	Source
Gini Coefficient	Measure of deviation of the distribution of income from a perfectly even distribution	World Bank
Palma Ratio	Ratio of the richest ten percent of the population's share of gross national income divided by the poorest 40 percent's share	UN Development Programme (UNDP)
Income Share of Top 10%	The percent of a country's total income that is earned by the top ten percent of earners	World Bank
Inequality in Income	Inequality in income estimated using Atkinson's Inequality Index from household surveys	UNDP
Coefficient of Human Inequality	Average inequality in 3 basic dimensions of human development	UNDP
Quintile Ratio	Ratio of the average income of the richest 20 percent to the average income of the poorest 20 percent	UNDP

Table 7 *Correlation Matrix: Inequality and Action Indicators*

	Gini Coefficient	Palma Ratio	Quintile Ratio	Inequality in income	Coefficient of Human Inequality	Income Share of Top 10%	Per Capita Emissions	% of Energy from Fossil Fuels
Gini Coefficient	1							
Palma Ratio	0.95	1						
Quintile Ratio	0.93	0.98	1					
Inequality in Income	0.92	0.94	0.94	1				
Coefficient of Human Inequality	0.80	0.78	0.70	0.69	1			
Income Share of Top 10%	0.87	0.84	0.80	0.76	0.74	1		
Per Capita Emissions	0.50	0.50	0.43	0.32	0.64	0.51	1	
% of energy from Fossil Fuels	0.54	0.54	0.478	0.41	0.66	0.57	0.80	1