ANALYZING THE POLITICAL AND ECONOMIC DETERMINANTS OF CLIMATE CHANGE MITIGATION POLICIES TO REDUCE GREENHOUSE GAS EMISSIONS

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ABSTRACT

Unless substantial reductions in greenhouse gas emissions are made, global warming will continue along with significant transformations to the earth's systems. This augments the risk of extreme, widespread and irreversible consequences for people and the natural world. Over the past twenty years, many governments have implemented policies to lower carbon outputs. Unfortunately, though, others remain hesitant to introduce such legislation. This is largely due to uncertainties surrounding the magnitude and distribution of the economic damages primed by climate change. Throughout this thesis, I will analyze the political and economic determinants which explain why certain countries adopt effective mitigation laws whereas others do not. Understanding this will be crucial for scholars and policymakers in developing strategies for nations to reduce their emissions as efficiently and inexpensively as possible.

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CHAPTER ONE: INTRODUCTION

Since the eighteenth century, the rapid industrialization and subsequent economic growth of mankind has resulted in perilous consequences for the natural world, including the extinctions of plant and animal species, pollution and climate change. Whereas past climates were guided by the earth's forces, today's climate is increasingly influenced by human activity. The primary catalyst of this is carbon dioxide, generated through the burning of fossil fuels. In 1850, atmospheric concentrations of CO_2 were 280 ppm (parts per million), yet at current levels of 413 ppm, they remain on the rise (Lindsey, 2020). According to scientific models, unless significant progress in reducing fossil fuel combustion is made, they could reach 1000 ppm by 2100 (Nordhaus, 2013). This is estimated to yield a 3-5 degrees Celsius global temperature increase, with substantial warming to follow (Nordhaus, 2013).

This thesis is comprised of multiple parts. The first provides an overview of various international agreements seeking to mitigate climate change and develops my primary hypotheses. The second portion tests those hypotheses, employing data covering up to 95 countries. Finally, the third section draws conclusions and suggests avenues for future work.

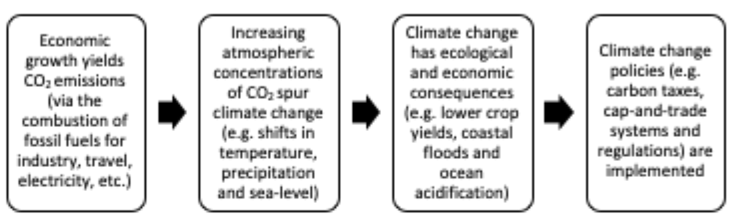
CHAPTER TWO: EFFORTS TO MITIGATE CLIMATE CHANGE

We are keenly aware and concerned about temperatures because they drive implications on human and natural systems. A critical notion in assessing impacts is whether systems may be managed. A managed system is one in which community members have undergone initiatives to guarantee the efficient and sustainable utilization of a resource. For instance, through the employment of well-engineered buildings, humans have rendered themselves capable of living in virtually all environments, from the desert to the tundra to outer space. Unfortunately, though, systems may be mismanaged. Burning trees for fuel illustrates this notion, as deforestation can yield desertification, flooding, increased concentrations of greenhouse gases, destruction of species, and copious issues for indigenous peoples. Alternatively, unmanaged systems are those which operate largely independent from human intervention. Systems may be unmanaged because individuals have opted to leave them be, as is the case with wildlife reserves, or because citizens are unable to regulate them given existing technologies, as is the case with tornados and sea-level rises.

The non-agricultural sectors of high-income countries are well managed, and hence, likely to adapt to environmental shifts at relatively low costs for at least the next several decades. Nonetheless, numerous systems—rain-fed agriculture, river runoffs and natural ecosystems, for instance—are unmanaged or unmanageable, rendering them exceedingly vulnerable to climate change. These are largely concentrated in low-income and tropical regions, wherein damages are expected to be most severe.

Researchers are particularly focused on the possibility of enhanced CO_2 concentrations inciting "tipping points" in the planet's systems (Nordhaus, 2013). These signify the crossing of environments over critical thresholds, provoking processes which cause abrupt transformations. Scientists project that, in the absence of successful mitigation measures, tipping points will lead to the rapid disintegration of large ice sheets, extensive fluctuations in ocean circulation, and feedback mechanisms wherein warming propels additional warming. Existing human technologies may be insufficient to manage these effects (IPCC, 2007).

The issue of global warming begins with economic growth, which yields CO_2 emissions through the burning of fossil fuels for industry, travel, electricity and more. This is exacerbated by market price distortions which encourage further combustion. Elevations in concentrations of carbon dioxide within the atmosphere then spur significant climate transformations, such as shifts in temperature, precipitation and sea-level. As this continues unchecked, human and natural systems are impacted. The ecological and economic consequences may include lower crop yields, coastal flooding, and ocean acidification. In response, governments may institute carbon taxes, cap-and-trade systems, or other regulations to reduce greenhouse gases. This interplay of economic growth, rising carbon dioxide emissions, climate change and policy is illustrated in the diagram below.



CHAPTER THREE: THE CLIMATE CRISIS AND EMISSIONS REDUCTIONS

Economic principles provide a valuable framework for understanding how the climate crisis came to be. The burning of fossil fuels, which releases greenhouse gases like CO_2, has externalities. While those who produce emissions do not pay to do so, those who are subsequently harmed receive no compensation. Economic theory maintains that unregulated markets lack the means to efficiently handle negative externalities. Hence, it is unsurprising that countries wherein there are zero prices on the external damages of combustion produce surpluses of carbon dioxide.

The economics of climate change suggests that mitigation will require the institution of market prices on CO_2 emissions. Fining individuals and corporations who release carbon dioxide could correct the shortcomings of the marketplace. This may be accomplished through the establishment of a "cap and trade" system, wherein regulatory tradeable limits exist for the quantity of allowable emissions, or by levying a "carbon tax" (Nordhaus, 2013). Both pose viable options for incentivizing people and firms to substitute their fossil fuel consumption for alternate energy sources.

Though mitigation, via carbon tax or other means, is essential for combating the climate crisis, the approach is expensive and difficult to achieve. Economists estimate that attaining international climate targets will cost a minimum of 1 to 2 percent of global income, or $600-1,200 billion yearly at today's level (Nordhaus, 2013). Moreover, since climate change stems from pollution originating in innumerable locations across every nation in the world, it must be resolved through global collective action. It will be impossible for any country to singlehandedly reduce their emissions quickly and deeply enough to prevent atmospheric concentrations of CO_2 from reaching dangerous levels. (victor, 2011)

Thus, international cooperation between high-income and low-income economies is crucial piece of the mitigation strategy.

To date, governments have pursued international cooperation through two multilateral agreements. The first agreement, called the United Nations Framework Convention on Climate Change (UNFCCC) took effect on March 21, 1994 (UNFCCC, 2020). Signed at the Rio Earth Summit in 1992, it is intrinsically tied to its sister Rio Conventions, the UN Convention on Biological Diversity and the Convention to Combat Desertification. The overall aim of the UNFCCC is to prevent "dangerous" environmental impacts induced by human activity. When the Convention entered into force over two decades ago, evidence for climate change was limited relative to today. Hence, its sheer acknowledgment of the issue was extraordinary. Borrowing a critical line from the Montreal Protocol of 1987, it encourages member states to behave in the interests of human safety despite scientific uncertainty. The UNFCCC operates under the assumption that industrialized nations should be held to the highest emissions reduction standards, as they have contributed the most to past and present GHG concentrations. Referred to as Annex I Parties, they encompass all the countries which belonged to the Organization for Economic Cooperation and Development (OECD) in 1992, in addition to the 12 "economies in transition" from Central and Eastern Europe.

The establishment of the UNFCCC was monumental for various reasons. Through the Convention, industrialized governments commit to sharing technology and financial assistance to less-developed states interested in taking climate action. Further, the agreement monitors the performance of Annex I nations by obligating them to report periodically on the status of their targets and emissions (UNFCCC, 2020). Developing nations are required to disclose this information as well, yet less frequently as funding for the preparation of reports can be difficult to obtain.

The Kyoto Protocol was inaugurated on February 16, 2005, after a convoluted ratification process spanning over seven years (UNFCCC, 2020). While the Convention asks countries to institute climate change mitigation measures and submit regular reports, the Kyoto Protocol binds industrialized parties to meeting explicit GHG targets. Following the logic of the UNFCCC, it places a greater burden on the developed states in accordance with the notion of "common but differentiated responsibility and respective capabilities" (UNFCCC, 2020).

The Paris Agreement, which was signed by heads of state in late 2015, is the second major international effort to achieve international climate cooperation (UNFCCC, 2020). The Paris Agreement represented a turning point in international climate relations as it explicitly indicated the goal of limiting global warming to 1.5°C or less. This year, the Paris Agreement enters a critical phase in which nations are due to disclose their revised Nationally Determined Contributions (NDCs) (Paris Agreement, 2015). NDCs underscore the climate related policies, targets, and measures which governments intend to execute. In conjunction, the success of these action plans determines whether the Paris Agreement's long-term goals are actualized. This includes achieving a global climax of greenhouse missions as soon as possible and carrying out drastic reductions thereafter using the best available technology.

Focusing solely on nations' emissions neglects the commitments of governments to mitigating climate change. Various determinants explain why emissions of greenhouse gases may increase regardless of strong environmental policies. For starters, developing nations may have concurrent economic development objectives. Despite some incredible mitigation measures, these countries frequently struggle to cut emissions as they undergo rapid urbanization and fossil fuel-based electrification. Moreover, climate legislation may be poorly implemented in states with low government effectiveness. This indicates not that a regime is ignoring environmental protection efforts, but that the outcomes of such initiatives may be improved by advancing the nation's administrative capacities. Third, countries have unique strategies for reducing their carbon outputs. Costa Rica, for example, has signed a decree to decarbonize its economy by 2050. China, on the other hand, has sought to reduce global emissions through bargains. During the 15^{th} session of the Conference of Parties (COP) in Copenhagen, Chinese representatives refused to negotiate unless the EU agreed to reduce its carbon outputs by 20% by 2020.

CHAPTER 4: HYPOTHESES, DATA, AND ANALYSES

4.1 Hypotheses

The Kyoto Protocol and the Paris Agreement rest on the underlying assumption that government policy can effectively reduce greenhouse gas emissions. These treaties form the basis of my two primary hypotheses, which are as follows:

H1: I predict that as the stringency of environmental policies rise, greenhouse gas emissions will decline.

H2: I predict that as state administrative capacity improves, greenhouse gas emissions will fall.

H3: I predict that as political institutions democratize, the stringency of environmental policies will rise.

H4: I predict that as state administrative capacity rises, the stringency of environmental policies will rise.

4.2 Data and Analysis

My dependent variable is greenhouse gas emissions per capita. This is measured in metric tons and is taken from data produced by the World Bank and Global Carbon Project. For my primary independent variable, I employ two indices of climate policy, the Climate Laws, Institutions and Measures Index (CLIMI) and the Climate Change Performance Index (CCPI) (Steves and Teytelboym, 2013; CCPI, 2020). CLIMI and CCPI follow a diverse array of nations which vary immensely in terms of democracy, state administrative capacity, size of dirty industry, and per capita wealth. They therefore compare the stringency of environmental policies worldwide. Nevertheless, they are flawed. Any index which seeks comprehensiveness and breadth maintains biases due to: (1) the arbitrariness by which individual components and subcomponents are weighted and (2) the uniform weighting of such components despite their varying relevance across governments. In spite of these problems, the two indices are the best existing measures.

CLIMI is available for 95 countries, which together produce 90% of greenhouse gas emissions. A list of these nations is included in Appendix 7.5. The key components of this measure are provided below, with relative weight and within-component sub-weights in parenthesis.

1) International cooperation (0.1)
   - Subgroups:
     - Kyoto ratification (0.5)
     - Joint Implementation (JI) or Clean Development Mechanism host (CDM) (0.5)

2) Domestic climate framework (0.4)
   - Subgroups:
     - Cross-sectoral climate change legislation (0.33)
     - Carbon emissions target (0.4)
     - Dedicated climate change institution (0.33)

3) Significant sectoral fiscal or regulatory measures or targets (0.4)
   - Subgroups:
     - Energy supplies/ renewables (0.3)
     - Industry (0.2)
     - Forestry (0.17)

- Agriculture (0.13)
- Transport (0.13)
- Buildings (0.07)

4) Additional cross-sectoral fiscal or regulatory measures (0.1)

CLIMI contains 12 constituent variables, organized into four main policy areas. Most of these values are allocated on a three-tier scale of 0, 0.5 and 1. A score of 0 signifies that a mitigation practice is non-existent, negligible or deceitful; a score of 0.5 designates that a policy or institution has been established, but that it falls substantially short of the greatest measure; and a score of 1 indicates the presence of the best procedure worldwide (though perhaps not in theory). There are two deviations from this ranking within the International Cooperation category. Values representing ratification of the Kyoto Protocol are distributed on a linear scale. Further, scores representing the existence of host projects under Joint Implementation or the Clean Development Mechanism are distributed on a binary scale. Ultimate CLIMI ratings are assigned between 0 and 1, with higher values denoting more stringent environmental policies. A chart displaying scoring, including the weighting of policy areas and their constituent variables, is shown in Appendix 7.6.

Nations with northern Europe, particularly the EU, tend to score highest on CLIMI. Indeed, between 2005 and 2010, the United Kingdom, Finland, France, Switzerland, and Spain led the index with CLIMI values of 0.801, 0.787, 0.783, 0.77, and 0.758, respectively. Norway, Denmark, Sweden, Slovenia, the Netherlands, Ireland, Germany, Belgium, the Czech Republic, Austria, and Italy followed in ranks 5 through 10. Alternatively, the lowest-scoring countries were largely concentrated in Africa. Mozambique, Saudi Arabia, Algeria, Sierra Leone, and Tonga lagged the metric in ranks 90 through 95, with scores of 0.023, 0.023, 0.016, 0.016, and

0.011, respectively. These nations experience significantly less international pressure to decarbonize, as their emissions are quite low relative to more developed economies. Likewise, they frequently demonstrate high levels of government ineffectiveness and corruption, rendering it difficult to implement comprehensive climate measures. A chart showcasing the CLIMI values of the 95 nations included within this study, from greatest to least, is included in Appendix 7.7.

CLIMI is a bit outdated as the most recent scores rely upon data from the UNFCC between 2005 and 2010. Hence, I also use the Climate Change Performance Index (CCPI), a second metric which attempts to capture and cross-nationally compare the essential components of climate policy "performance." CCPI monitors 57 countries and the European Union, which together generate over 90% of GHG emissions, and releases updated values annually. A list of these nations is included in Appendix 7.8. The key components of this measure are provided below, with relative weight and within-component sub-weights in parenthesis.

1) GHG Emissions (0.4)
- Subgroups:
  - Current level of GHG emissions per capita (0.25)
  - Past trend of GHG emissions per capita (0.25)
  - Current level of GHG emissions per capita compared to a well-below-2°C compatible pathway (0.25)
  - GHG emissions reduction 2030 target compared to a well-below-2°C compatible pathway (0.25)

2) Renewable energy (0.2)
- Subgroups:
  - Current share of renewables per TPES (0.25)

- ▪ Development of energy supply from renewable energy sources (0.25)
- ▪ Current share of renewables per TPES compared to a well-below-2°C compatible pathway (0.25)
- ▪ Renewable energy 2030 target compared to a well-below-2°C compatible pathway (0.25)

3) Energy use (0.2)

- o Subgroups:
  - Current level of energy use (TPES/Capita) (0.25)
  - Past trend of TPES/Capita (0.25)
  - Current level of TPES/Capita compared to a well-below-2°C compatible pathway (0.25)
  - TPES/Capita 2030 target compared to a well-below-2°C compatible pathway (0.25)

4) Climate Policy (0.2)

- o Subgroups:
  - National climate policy (0.5)
  - International Climate Policy (0.5)

In hopes of offering the most holistic, equitable evaluation of such countries, the index considers 14 indicators. Approximately 80% of a nation's score is derived from quantitative data extracted from the Food and Agriculture Organization (FAO), PRIMAP, the International Energy Agency (IEA), and federal GHG inventories sent to the UNFCC. The "GHG Emissions," "Renewable Energy," and "Energy Use" categories are broken into four subcomponents: (1) Current Level; (2) Past Trend; (3) Well-Below-2°C Compatibility of the Current Level; and (4) Well-Below-2°C Compatibility of the Countries' 2030 Target. The CCPI recognizes that it may take several years for the efforts undertaken by states to lower GHG emissions and substitute renewable energy sources for nonrenewable ones to yield notable effects on these three dimensions. The final category, "Climate Policy," therefore acknowledges any recent developments regarding domestic environmental policy frameworks which quantitative data fails to represent. The subcomponents for this category are (1) National Climate Policy and (2) International Climate Policy. The qualitative data for these is determined yearly by non-governmental organizations, universities and think tanks that operate within the countries that are assessed. A comprehensive table displaying the weighting of policy areas and their constituent variables can be found in Appendix 7.4.

Values for each indicator are distributed on a 0 to 100 scale, with 0 representing the bottom cut off and 100 representing the maximum score that can be achieved. If a nation performs best in one indicator (relative to the other nations monitored by CCPI), it receives full points in that indicator. Final rankings for CCPI are calculated as the weighted average of the achieved scores across all fourteen indicators. The following equation is used:

$$I = \sum_{i=1}^{n} w_i X_i$$

I: Climate Change Performance Index
X_i: normalized indicator
w_i: weighting of X_i

$$\sum_{i=1}^{n} w_i = 1 \; and \; 0 \leq w_i \leq 1$$

I: 1,…,n: number of partial indicators (currently 14)

Score = 100 $\left(\frac{actual\ value - minimum\ value}{maximum\ value - minimum\ value}\right)$ (CCPI, 2020).

There are several important considerations to bear in mind when interpreting CCPI scores. Firstly, values are obtained exclusively from production-based emissions. Production-based emissions encompass only those that occur within a nations' borders and the territories over which it has jurisdiction. Consumption-based emissions, on the other hand, reflect the effects of trade. This includes the emissions generated during the production of imports and distribution of exports. Consequently, the CCPI abides by the contemporary method of computing country emissions, wherein states are responsible for the greenhouse gases they emit. Secondly, most of index's subcategories are evaluated in relative terms, of better or worse, rather than absolute. Thus, high-scoring nations still have an incentive to expand their mitigation measures. After all, even if every country and the European Union performed as well as the frontrunner, dangerous climate change could ensue. A chart showcasing all 2017 CCPI scores, ranked from greatest to least, is listed in Appendix 7.9.

For comparative purposes, I also include a list of CCPI 2020 values in Appendix 7.10. The CCPI 2020 results illuminate the primary regional differences in environmental protection. Unfortunately, no single nation performs strongly enough across all subcategories to achieve a comprehensive "very high" ranking. Resultantly, the premier three ranks remain empty. This year, Sweden leads the index in rank 4, followed by Denmark in rank 5, and Morocco in rank 6. Conversely, Iran scores the fifth lowest country in rank 57, followed by South Korea in rank 58, Saudi Arabia in rank 60, and the United States in rank 61. Across nearly all categories, these governments scored low to very low. A table depicting all 2020 CCPI values is listed in Appendix 5.6.

Sweden ranks fourth and remains the frontrunner within high-performing nations on the CCPI 2019 and 2020. It performs high across the GHG Emissions, Renewable Energy and Climate Policy categories. Still, it receives low rankings on the Energy Use category. This is due to the country's high level of per capita energy use as well its lack of a well-below-2° compatible target. While domestic experts praise Sweden's ambitious climate policy framework, notably its commitment to achieving 100% renewable energy by 2040, target of net-zero emissions by 2045, and implementation of the highest carbon tax globally, they encourage the nation to establish an explicit energy use target and set forth stronger incentivizes for energy efficiency. Though Sweden exhibits a relatively high dedication to mitigating climate change, even its current efforts are insufficient to achieving the central goal of the Paris Agreement. The country would have to attain net zero emissions by 2030 and substantially reduce its consumption-based emissions in order to position itself on a well-below-2°C pathway. Still, Sweden is a strong advocate of stringent environmental action and a primary contributor to the Green Climate Fund (GCF). GCF, the world's largest fund dedicated to helping developing nations cut their GHG outputs and respond to climate change, was created by the 2010 UNFCCC and has served a crucial role in supporting the Paris Agreement's aim of ensuring that average global warming is kept well below 2° C. Considering this, Sweden retains a very high international climate policy performance rating by national pundits.

Conversely, the United States ranked last on the CCPI in 2020 and has received very low ratings across the indicator's four categories. Despite the country's extremely high GHG emissions, it has failed to institute a target or policy for improvement. The US' poor score is largely due to its highly inefficient public transportation system and destructive, unsustainable farm and forest practices. Experts highlight that America's domestic environmental laws have significantly worsened under the Trump administration and emphasize the importance of state-level initiatives. Whereas certain states have instituted energy use reduction and renewable energy targets, these efforts vary immensely in terms of strength and execution. On the global scale, the United States functions as a destructive player for international negotiations. Indeed, America's very low classification is further underpinned by the Trump regime's decision to officially withdraw from the Paris Agreement on November 4, 2020.

4.3 Control Variables

In addition to testing for my primary variables I hold a number of variables constant.

4.3.1 Level of Democracy

Within my regressions, I control for regime type using Freedom House's freedom scale (Freedom House, 2020). Freedom House publishes annual *Freedom in the World* reports wherein it assigns countries two numerical scores, one denoting political rights and one denoting civil liberties. These values are based on 1 to 7 indexes, with 1 signifying the most free and 7 signifying the least free. The organization then computes the average of these two values, the figure which it uses to determine a nation's status as Free (1.0 to 2.5), Partly Free (3.0 to 5.0), or Not Free (5.5 to 7.0).

In order to account for the unique circumstances and nuances experienced in different countries, the Political Rights and Civil Liberties metrics are underpinned by comprehensive forty-point and sixty-point scales, respectively. With the aim of encouraging debate and international discussions regarding how to improve such ratings, the group also releases distinct scores for each of the seven subcategories encompassed by political rights and civil liberties. This includes an individual's capacity to vote freely in legitimate elections; participate in the political process; be represented by politicians who are accountable to them; exercise freedoms of expression and belief; assemble and associate; access a robust, nonpartisan rule of law; and enjoy social and economic freedoms, such as the capacity to obtain private property.

Additionally, I control for democracy using the Worldwide Governance Indicators' (WGI) Voice and Accountability index (WGI, 2020). Voice and accountability depicts "the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media" (WGI, 2020).

4.3.2 State Administrative Capacity

WGI offers five indices which together afford a holistic picture of a state's administrative capacity. It tracks the following dimensions: Control of Corruption; Rule of Law; Political Stability; Government Effectiveness; and Regulatory Quality, for over 200 countries and territories between 1996 and 2018 (WGI, 2020). Scores across these aggregate indicators reflect the survey responses of numerous citizens, pundits, and enterprises operating in both developed and developing nations. They are derived from more than 30 individual data sources generated by a plethora of private sector firms, non-governmental organizations, think tanks, and survey institutes.

Control of corruption "captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests" (WGI, 2020). Rule of Law reflects "the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence" (WGI, 2020). Political Stability portrays the "likelihood of political instability and/or politically motivated violence, including terrorism" (WGI, 2020). Government effectiveness assesses "the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies" (WGI, 2020). Finally, regulatory quality gauges "the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development" (WGI, 2020).

4.3.3 Size of carbon industry

Mitigation measures may be greatly hindered by the carbon-intensive industry, particularly if it employs a large portion of the electorate and contributes significantly to tax revenue. Yet despite its tremendous influence over climate change policies and initiatives, the strength of the carbon-intensive industry lobby is quite difficult to measure. In order to account for this determinant, I consider the manufacturing, value added (% GDP) indicator offered by the World Bank (World Bank, 2020). Manufacturing is defined as any industries belonging to divisions 15-37 of the International Standard Industrial Classification (ISIC). Value added equates to the net output of a sector once intermediate inputs are subtracted from combined total outputs.

4.3.4 Average Living Standard

Finally, wealth per capita may substantially affect political commitments to climate change mitigation. In acknowledgement of this, I control for each nation's average living standard using the World Bank's GDP per capita indicator (World Bank, 2020). GDP per capita reflects the total value of all goods and services produced within a nation's borders over a given interval, divided by population.

CHAPTER 5: REGRESSION RESULTS

After running the linear regressions, displayed in Appendix 7.1-7.4, I have determined that there is highly significant negative correlation between the stringency of environmental policies, as operationalized by CLIMI, and greenhouse gas emissions. Table 1 reports the results of regressing CLIMI on carbon outputs. Moving in the direction of left to right, from Model A to I, I control for a number of extraneous variables. This includes each nation's level of democracy as operationalized by Freedom House's Political Rights and Civil Liberties indices and the Worldwide Governance Indicators' Voice and Accountability metric; state administrative capacity as operationalized by the World Bank's Control of Corruption, Rule of Law, Political Stability, Government Effectiveness, and Regulatory Quality measures; size of dirty industry as operationalized by the World Bank's Manufacturing Value Added index; and average living standard as operationalized by GDP per capita. The coefficients indicate the extent to which these variables are responsible for variances in emissions. Values greater than zero demonstrate a positive influence on carbon outputs whereas values less than zero demonstrate a negative influence on carbon outputs. Highly significant relationships are denoted by three stars and semi-significant relationships are denoted by two.

As model A in this table illustrates, the negative correlation between CLIMI and emissions is highly significant in and of itself. This relationship holds when controlling for three different metrics of democracy: Political Rights in model B, Civil Liberties in model C, and Voice and Accountability in model D. Moreover, it remains when various measures of state administrative capacity are held constant: Control of Corruption in model E, Rule of Law in model F, Political Stability in model G, Government Effectiveness in model H, and Regulatory Quality in Model I. In all of these models, aside from model A, I control for the size of dirty industry and GDP per capita. My regressions prove that both of these variables have significant positive correlations with CO_2 outputs.

A highly significant negative correlation also exists between CCPI and emissions. Table 2 reports the results of regressing CCPI on carbon outputs. Moving in the direction of left to right, from Model A to I, I control for the same external variables as I have in Table 1. Interestingly, I find no statistically significant positive correlation between the size of dirty industry and emissions. This is likely an issue of multilinearity, as the CCPI index accounts for this variable through its "Renewable Energy" component.

Within Table 3, I analyze the implications of political institutions and administrative capabilities on CLIMI. Models A-C support my third hypothesis that as political institutions democratize, environmental polices become increasingly stringent. Indeed, I identify a highly significant negative correlation between Political Rights and CLIMI in model A, a highly significant negative correlation between Civil Liberties and CLIMI in model B, and a highly significant positive correlation between Voice and Accountability and CLIMI in model C. Models D-H support my fourth hypothesis that as state administrative capacity rises, so too does the rigor of climate regulations. These models demonstrate a highly significant positive correlation between CLIMI and Control of Corruption, Rule of Law, Political Stability, Government Effectiveness, and Regulatory Quality, respectively.

Lastly, in Table 4, I examine the effects of political institutions and administrative capabilities on CCPI. Models A-C support my third hypothesis that as political institutions democratize, environmental polices become increasingly stringent. Indeed, I identify a highly significant negative correlation between Political Rights and CCPI in model A, a highly significant negative correlation between Civil Liberties and CCPI in model B, and a highly significant positive correlation between Voice and Accountability and CCPI in model C. Models D-H depict no statistically significant relationships between CCPI and Control of Corruption, Rule of Law, Political Stability, Government Effectiveness, or Regulatory Quality. The absence of positive correlations between CCPI and these variables, despite the positive correlation I identify between them and CLIMI, reflects the unique composition of the climate policy indices. Whereas CLIMI places a greater emphasis on the administrative roles of governance, CCPI is more focused on the legislative roles.

CHAPTER 6: CONCLUSIONS AND AVENUES FOR FUTURE WORK

This thesis uses CLIMI and CCPI, two metrics which strive to cross-nationally compare the essential components of climate policy performance, to explain why certain countries display high levels of carbon emissions whereas others do not. My analysis generates a number of powerful conclusions which support my theoretical assumptions. In regressing CLIMI and CCPI on CO_2 outputs, I conclude that stringent environmental laws are correlated with lower emissions. Next, in regressing metrics of regime type on these indexes, I find democracy and government effectiveness to be strong drivers of rigorous climate policies. These results are important as they suggest that mitigation may be achieved through robust federal policies, capable domestic institutions, and global democratization.

Nevertheless, my thesis offers many avenues for future work. CLIMI was last updated in 2010 and would therefore benefit from revisions to its international cooperation section, which emphasizes ratification of and commitment to the Kyoto Protocol rather than the Paris Agreement. Additionally, both CLIMI and the CCPI could be improved through an expansion of country coverage.

This thesis examines a broad set of countries and attempts to understand the political and economic determinants which lead them to adopt mitigation measures. While this important, it would be useful to conduct case studies on superpowers such as China and the United States, which emit excessive quantities of greenhouse gases relative to developing nations. Finally, my study is founded upon literature which proves that the size of the carbon-intensive industry lobby and wealth per capita have positive correlations to carbon outputs. It would be interesting to understand how these determinants interact with one another to do so.

APPENDIX

7.1 Effects of CLIMI on Carbon Emissions

Table 1: Effects of CLIMI on Carbon Emissions									
	Model A	Model B	Model C	Model D	Model E	Model F	Model G	Model H	Model I
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
CLIMI	-3.765***	-3.791**	-3.871**	-4.036**	-4.333***	-4.497***	-4.043**	-6.429***	-7.667***
	-1.08	-1.32	-1.31	-1.3	-1.3	-1.27	-1.29	-1.25	-1.21
Political Rights		-0.009			0.25	0.445***	0.202	0.448***	0.610***
		-0.12			-0.13	-0.13	-0.13	-0.12	-0.12
Civil Liberties			-0.027						
			-0.15						
Control of Corruption					1.745***				
					-0.37				
Rule of Law						2.507***			
						-0.37			
Political Stability							1.454***		
							-0.29		
Voice and Accountability				0.106					
				-0.29					
Government Effectiveness								3.692***	
								-0.38	
Regulatory Quality									4.234***
									-0.36
Manufacturing Value	0.085**	0.085**	0.085**	0.087**	0.066*	0.059*	0.084**	0.028	0.062*
	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
GDP per capita (Current $US)	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	0	0	0	0	0	0	0	0	0
Constant	2.732***	2.766***	2.834***	2.792***	3.207***	2.966***	2.578***	4.220***	3.120***
	-0.47	-0.7	-0.75	-0.5	-0.7	-0.68	-0.69	-0.67	-0.63
R-sqr	0.345	0.345	0.345	0.345	0.371	0.397	0.374	0.442	0.482
Dfres	538	534	534	537	533	533	533	533	533
BIC	3097.827	3089.637	3089.609	3103.984	3073.952	3051.109	3071.111	3009.478	2968.595

7.2 Effects of CCPI on Carbon Emissions

Table 2: Effects of CCPI on Carbon Emissions

	Model A	Model B	Model C	Model D	Model E	Model F	Model G	Model H	Model I
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
CCPI	-0.301***	-0.336***	-0.334***	-0.330***	-0.338***	-0.341***	-0.333***	-0.333***	-0.328***
	-0.08	-0.09	-0.08	-0.08	-0.09	-0.09	-0.09	-0.09	-0.08
Political Rights		-0.398			-0.297	-0.225	-0.231	-0.273	0.017
		-0.29			-0.31	-0.34	-0.33	-0.33	-0.37
Civil Liberties			-0.641						
			-0.35						
Control of Corruption					0.821				
					-0.82				
Rule of Law						0.859			
						-0.9			
Political Stability							0.81		
							-0.81		
Voice and Accountability				1.081					
				-0.69					
Government Effectiveness								0.806	
								-1	
Regulatory Quality									1.69
									-0.97
Manufacturing Value Added	-0.032	0.003	0.012	0.011	-0.002	-0.008	-0.015	-0.008	-0.03
	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.08	-0.07	-0.07
GDP per capita (Current $US)	0.000***	0.000***	0.000***	0.000**	0	0.000*	0.000**	0.000*	0
	0	0	0	0	0	0	0	0	0
Constant	21.603***	24.143***	24.619***	22.484***	24.277***	24.178***	24.017***	23.703***	22.887***
	-5.14	-5.39	-5.23	-5.06	-5.4	-5.4	-5.4	-5.45	-5.28
R-sqr	0.503	0.531	0.55	0.538	0.545	0.544	0.545	0.54	0.573
Dfres	33	32	32	32	31	31	31	31	31
BIC	178.75	180.219	178.673	179.66	182.662	182.749	182.668	183.065	180.37

7.3 Effects of Political Institutions and State Administrative Capacity on CLIMI

Table 3: Effects of Political Institutions and State Administrative Capacity on CLIMI								
	Model A	Model B	Model C	Model D	Model E	Model F	Model G	Model H
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
Political Rights	-0.052***							
	0							
Civil Liberties		-0.065***						
		0						
Control of Corruption				0.107***				
				-0.01				
Rule of Law					0.112***			
					-0.01			
Political Stability						0.067***		
						-0.01		
Voice and Accountability			0.123***					
			-0.01					
Government Effectiveness							0.144***	
							-0.01	
Regulatory Quality								0.148***
								-0.01
Manufacturing Value	0.008***	0.009***	0.008***	0.007***	0.007***	0.008***	0.005***	0.006***
	0	0	0	0	0	0	0	0
GDP per capita (Current $US)	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000**	0.000***
	0	0	0	0	0	0	0	0
Constant	0.291***	0.317***	0.136***	0.179***	0.177***	0.123***	0.208***	0.175***
	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
R-sqr	0.664	0.66	0.66	0.57	0.583	0.54	0.61	0.638
Dfres	536	536	540	540	540	539	540	540
BIC	-598.163	-591.779	-597.038	-468.933	-486.034	-431.753	-522.114	-563.001

7.4 Effects of Political Institutions and State Administrative Capacity on CCPI

Table 4: Effects of Political Institutions and State Administrative Capacity on CCPI								
	Model A	Model B	Model C	Model D	Model E	Model F	Model G	Model H
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
Political Rights	-2.374***							
	-0.62							
Civil Liberties		-2.842***						
		-0.76						
Control of Corruption				2.649				
				-2.48				
Rule of Law					3.229			
					-2.33			
Political Stability						2.832		
						-1.96		
Voice and Accountability			5.990***					
			-1.51					
Government Effectiveness							2.298	
							-2.81	
Regulatory Quality								2.646
								-2.19
Manufacturing Value	-0.069	-0.09	-0.06	-0.216	-0.22	-0.236	-0.232	-0.213
	-0.18	-0.18	-0.18	-0.2	-0.2	-0.2	-0.2	-0.2
GDP per capita (Current $US)	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
Constant	62.207***	64.006***	54.949***	57.324***	56.970***	57.673***	56.512***	56.392***
	-3.73	-3.96	-3.4	-3.92	-3.83	-3.9	-3.87	-3.84
R-sqr	0.282	0.278	0.297	0.088	0.102	0.105	0.079	0.094
Dfres	48	48	48	48	48	48	48	48
BIC	368.194	368.47	367.109	380.647	379.839	379.659	381.151	380.314

7.5 Nations Included in CLIMI

1. United Kingdom
2. Finland
3. France
4. Switzerland
5. Spain
6. Norway
7. Denmark
8. Sweden
9. Slovenia
10. Netherlands
11. Ireland
12. Germany
13. Belgium
14. Czech Republic
15. Austria
16. Italy
17. Japan
18. South Korea
19. Lithuania
20. Greece
21. New Zealand
22. Iceland
23. Costa Rica
24. Romania
25. Poland
26. Mexico
27. China
28. Hungary
29. Singapore
30. Portugal
31. Brazil
32. Bulgaria
33. South Africa
34. Peru
35. Latvia
36. Slovak Republic
37. Indonesia
38. Argentina
39. Ukraine
40. Estonia
41. Turkey

42. Uruguay
43. India
44. Vietnam
45. Colombia
46. United States
47. Morocco
48. Dominican Republic
49. Canada
50. Bolivia
51. Macedonia
52. Croatia
53. Mongolia
54. Egypt
55. Australia
56. Belarus
57. Uzbekistan
58. Moldova
59. Georgia
60. Fiji
61. Kazakhstan
62. Kyrgyzstan
63. Armenia
64. Albania
65. Malta
66. Rwanda
67. United Arab Emirates
68. Jordan
69. Sao Tome and Principe
70. Samoa
71. Serbia
72. Russia
73. Tajikstan
74. Montenegro
75. Turkmenistan
76. Azerbaijan
77. DR Congo
78. Venezuela
79. Senegal
80. Guinea-Bissau
81. Bahrain
82. Cameroon
83. Bosnia and Herzegovina
84. Mauritania

85. Cote d'Ivoire
86. Congo
87. Burundi
88. Madagascar
89. Niger
90. Mozambique
91. Saudi Arabia
92. Algeria
93. Suriname
94. Sierra Leone
95. Tonga

7.6 Structure of CLIMI

Table 5: Structure of CLIMI

Policy area	Policy area weight	Constituent Variables	Scoring	Variable weights
International cooperation	0.1	Kyoto ratification	Linear from 0 (not ratified) to 1 (earliest ratification)	0.5
		JI or CDM	None (0), existence (1) (even if no CERs have been issued yet)	0.5
Domestic climate framework	0.4	Cross sectoral climate change legislation	0/0.5/1	0.33
		Carbon emissions target	0/0.5/1	0.33
		Dedicated climate change institution	0/0.5/1	0.33
Significant sectoral fiscal or regulatory measures or targets	0.4	Energy supply and renewable energy	0/0.5/1	0.30
		Transport	0/0.5/1	0.13
		Buildings	0/0.5/1	0.07
		Agriculture	0/0.5/1	0.13
		Forestry	0/0.5/1	0.17
		Industry	0/0.5/1	0.20
Additional cross-sectoral fiscal or regulatory measures	0.1	Cross-sectoral policy measures	0/0.5/1	1.0

7.7 Nations Included in CCPI

1. France
2. Sweden
3. United Kingdom
4. Cyprus
5. Morocco
6. Luxembourg
7. Malta
8. Portugal
9. Belgium
10. Denmark
11. Switzerland
12. Latvia
13. Italy
14. Croatia
15. Romania
16. Lithuania
17. India
18. Ireland
19. Indonesia
20. Egypt
21. Czech Republic
22. Greece
23. Slovakia
24. Netherlands
25. Mexico
26. Germany
27. Slovenia
28. Finland
29. South Africa
30. Spain
31. Hungary
32. Poland
33. Argentina
34. Bulgaria
35. Norway
36. Iceland
37. Brazil
38. Austria
39. Thailand
40. United States
41. Malaysia
42. Ukraine

43. New Zealand
44. Algeria
45. China
46. Belarus
47. Estonia
48. Turkey
49. Taiwan
50. Russia
51. Singapore
52. Canada
53. Iran
54. Australia
55. South Korea
56. Kazakhstan
57. Japan
58. Saudi Arabia

7.8 Structure of CCPI

Table 6: Structure of CCPI			
Category	Category weight	Constituent indicators	Indicator weights
GHG emissions	0.4	Current level	0.25
		Past trend	0.25
		Well-Below-2°C compatibility of current level	0.25
		Well-Below-2°C compatibility of 2030 target	0.25
Renewable energy	0.2	Current level	0.25
		Past trend	0.25
		Well-Below-2°C compatibility of current level	0.25
		Well-Below-2°C compatibility of 2030 target	0.25
Energy use	0.2	Current level	0.25
		Past trend	0.25
		Well-Below-2°C compatibility of current level	0.25
		Well-Below-2°C compatibility of 2030 target	0.25

Climate policy	0.2	National climate policy	0.50
		International climate policy	0.50

7.9 CLIMI Results

Rank	Country	CLIMI
1	United Kingdom	0.801
2	Finland	0.787
3	France	0.783
4	Switzerland	0.77
5	Spain	0.758
6	Norway	0.749
7	Denmark	0.722
8	Sweden	0.701
9	Slovenia	0.698
10	Netherlands	0.691
11	Ireland	0.667
12	Germany	0.665
13	Belgium	0.66
14	Czech Republic	0.653
15	Austria	0.641
15	Italy	0.641
17	Japan	0.636
18	South Korea	0.629
19	Lithuania	0.615
20	Greece	0.608
21	New Zealand	0.602
22	Iceland	0.561
23	Costa Rica	0.517
24	Romania	0.497
25	Poland	0.496
26	Mexico	0.486
27	China	0.485
28	Hungary	0.483
29	Singapore	0.468
29	Portugal	0.468
31	Brazil	0.464

32	Bulgaria	0.457
33	South Africa	0.456
34	Peru	0.437
35	Latvia	0.433
36	Slovak Republic	0.422
37	Indonesia	0.402
38	Argentina	0.401
39	Ukraine	0.398
40	Estonia	0.383
41	Turkey	0.381
42	Uruguay	0.369
43	India	0.358
44	Vietnam	0.345
45	Colombia	0.34
45	United States	0.34
47	Morocco	0.339
48	Dominican Republic	0.319
49	Canada	0.316
50	Bolivia	0.296
51	FYR Macedonia	0.293
52	Croatia	0.29
53	Mongolia	0.288
54	Egypt	0.267
55	Australia	0.265
56	Belarus	0.262
56	Uzbekistan	0.262
58	Moldova	0.247
59	Georgia	0.238
60	Fiji	0.233
61	Kazakhstan	0.226
62	Kyrgyz Republic	0.214
63	Armenia	0.201
64	Albania	0.199
65	Malta	0.183
66	Rwanda	0.182
67	United Arab Emirates	0.159
68	Jordan	0.156
69	Sao Tome and Principe	0.143

70	Samoa	0.142
71	Serbia	0.139
72	Russia	0.134
72	Tajikstan	0.134
74	Montenegro	0.133
75	Turkmenistan	0.115
76	Azerbaijan	0.108
77	DR Congo	0.091
78	Venezuela	0.09
79	Senegal	0.088
80	Guinea Bissau	0.087
81	Bahrain	0.086
82	Cameroon	0.084
83	Bosnia and Herzegovina	0.081
84	Mauritania	0.071
85	Cote d'Ivoire	0.064
86	Congo	0.049
87	Burundi	0.037
88	Madagascar	0.029
89	Niger	0.025
90	Mozambique	0.023
90	Saudi Arabia	0.023
90	Algeria	0.023
93	Suriname	0.016
93	Sierra Leone	0.016
95	Tonga	0.011

7.10 CCPI 2017 Results

Rank	Country	CCPI 2017
4	France	66.17
5	Sweden	66.15
6	United Kingdom	66.1
7	Cyprus	64.28
8	Morocco	63.28
9	Luxembourg	62.86
10	Malta	62.51

11	Portugal	62.47
12	Belgium	62.08
13	Denmark	61.87
14	Switzerland	61.66
15	Latvia	61.2
16	Italy	60.72
17	Croatia	60.66
18	Romania	60.33
19	Lithuania	59.75
20	India	59.08
21	Ireland	59.02
22	Indonesia	58.86
23	Egypt	58.75
24	Czech Republic	58.52
25	Greece	58.29
26	Slovak Republic	57.69
27	Netherlands	57.1
28	Mexico	57.02
29	Germany	56.58
30	Slovenia	56.55
31	Finland	56.28
32	South Africa	56.17
33	Spain	56.14
34	Hungary	55.05
35	Poland	53.68
36	Argentina	53.15
37	Bulgaria	53.06
38	Norway	52.9
39	Iceland	52.55
40	Brazil	52.46
41	Austria	52
42	Thailand	51.91
43	United States	51.04
44	Malaysia	50.96
45	Ukraine	50.88
46	New Zealand	50.48
47	Algeria	48.46
48	China	47.49
49	Belarus	46.86

50	Estonia	46.04
51	Turkey	45.54
52	Taiwan	44.76
53	Russia	44.3
54	Singapore	43.97
55	Canada	43.06
56	Iran	43.05
57	Australia	40.66
58	South Korea	38.11
59	Kazakhstan	36.87
60	Japan	35.93
61	Saudi Arabia	25.45

7.11 CCPI 2020 Results

Rank	Country	CCPI 2020
4	France	75.77
5	Sweden	71.14
6	United Kingdom	70.63
7	Cyprus	69.8
8	Morocco	66.22
9	Luxembourg	66.02
10	Malta	63.25
11	Portugal	62.88
12	Belgium	61.14
13	Denmark	60.91
14	Switzerland	60.76
15	Latvia	60.75
16	Italy	60.61
17	Croatia	60.6
18	Romania	57.9
19	Lithuania	57.53
20	India	56.97
21	Ireland	55.82
22	Indonesia	55.82
23	Egypt	55.78
24	Czech Republic	54.85

25	Greece	54.1
26	Slovak Republic	53.92
27	Netherlands	52.69
28	Mexico	52.59
29	Germany	50.89
30	Slovenia	48.16
31	Finland	48.05
32	South Africa	47.01
33	Spain	46.76
34	Hungary	46.03
35	Poland	45.73
36	Argentina	45.67
37	Bulgaria	45.67
38	Norway	44.74
39	Iceland	44.65
40	Brazil	44.18
41	Austria	44.04
42	Thailand	43.77
43	United States	42.93
44	Malaysia	41.91
45	Ukraine	41.66
46	New Zealand	41.45
47	Algeria	41.17
48	China	40.76
49	Belarus	40.12
50	Estonia	39.98
51	Turkey	39.03
52	Taiwan	37.85
53	Russia	34.21
54	Singapore	33.39
55	Canada	31.01
56	Iran	30.75
57	Australia	28.41
58	South Korea	26.75
59	Kazakhstan	23.33
60	Japan	22.03

61	Saudi Arabia	18.6

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