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Explaining Variations in Response to the Threat of Climate Change

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Catherine Callahan

Senior Thesis Spring 2010

Explaining Variations in Response to the Threat of Climate Change

Introduction

The issue of climate change is one that is at the forefront of our global society. The Intergovernmental Panel on Climate Change (IPCC) currently predicts an increase of global temperature of 1.5-6°C in this century (Clark and York 2005; Oreskes 2004), any increase over 4°C would make the earth hotter than it has been in over 40 million years, and could be threatening to the survival of human civilization (Clark and York 2005; Foster 2002). CO₂ emissions from anthropogenic processes have been greatly increasing since industrialization since humans began burning coal and petroleum for energy, the scientific community has developed consensus that climate change is largely a result of these CO₂ emissions. (Clark and York 2005; Baer 2008). Although the IPCC estimates that carbon (CO₂) emissions need to be reduced by at least 60% to prevent substantial climate change emissions are continuing to be created at rates faster than carbon sinks can absorb them (Clark and York 2005; Simms 2001). Carbon sinks are non-living things such as glaciers; rocks; or oceans, as well as plants that absorb carbon in photosynthetic processes (Clark and York 2005). There have been some actions taken to mitigate climate change, such as the Kyoto Protocol and the cutting of emissions in the EU. While there is scientific consensus about climate change, there has not been consensus among states' reactions to climate change and there are several explanations as to why this maybe the case. My research is going to look at what is causing these variations in reactions.

Climate change is already having an impact on the earth and the global population, the UN Environment Program estimates that the extra economic costs of disasters attributable to

climate change are costing over \$300 billion annually (Sims 2001). There is concern about climate change in the media with movies such as An Inconvenient Truth and Day After Tomorrow. Individual citizens have become concerned about climate change in a multitude of states, but their government's policies do not always demonstrate this concern, which caused me to be interested in what might be behind this disconnect.

Lit Review

The Kyoto Protocol is the most recent international treaty on climate change; developed in 1997 it was the first treaty to include targets and timetables on emissions. (Barret 1998) The development of the Kyoto Protocol relied on several theories, and its limits and failures can also be explained by theories in international relations. There have been previous cases of success in mitigating different environmental damages on an international level, especially the Montreal Protocol. Throughout the development and implementation of Kyoto it was apparent that there were some states who were more motivated to take action against climate change either through international regimes or by themselves. This was true especially highly developed states in Western Europe.

One argument behind how effective Kyoto is going to be is Arild Underdal's "law of the least ambitious program" (LLAP), which holds that the commitment level of the agreement's least interested party limits the effectiveness of an international agreement. (Victor 2006) The LLAP has been a significant part of the research done on environmental regulation because according to Hovi and Sprinz, "According to the LLAP, the main reason is that the unanimity rule places the final word with the party most likely to be dragging its feet. Hence, ambitious new regulation becomes unlikely." Hovi and Sprinz argue that there are limits to the LLAP because there are cases where voting is not required to be unanimous and there are cases where

there has been success without ambition from all parties. (2006) It is interesting to note that Hovi and Sprinz are referring to passage of international agreements, which does not necessarily refer to the effectiveness of an agreement once it is put into place.

Issues of enforcement especially in regards to international environmental law are a huge problem:

At the international level no supranational institution exists that can impose necessary instruments on countries to reduce the problem. Environmental problems are instead managed by voluntary agreements among a group of countries. Efforts to solve international environmental problems and thus also enforcement issues thus tend to a much greater extent to focus on negotiations and coordination, not on government intervention as is the case for national environmental problems. (Malvik and Westkog 2001)

The problem of a “tragedy of the commons” is something prominent in the literature on climate change. There is often the issue when examining the predicted effects of climate change because the losers of climate change are not the largest emitters. The Kyoto Protocol has not solved the problem of enforcement in environmental law; therefore there is a need for a motivation aside from being a signatory on this international treaty in order to convince states to cut back on their emissions of greenhouse gases. Victor, in criticizing Kyoto explains that without enforcement in international law the treaty becomes pointless:

The world’s largest emitter, the US, is not a member of the treaty. The second largest emitter, the EU, has joined Kyoto and is making some significant efforts toward compliance, but these barely alter the global trajectory of CO₂ emissions. The third largest emitter, China, is a member but faces no limit on its emissions (which will soon surpass those of the EU). The fourth largest emitter, Russia, is a member only because the treaty condones inaction and offers the prospect of profit from selling surplus emission credits. The fifth largest emitter is Japan, whose interests are similar to those of the EU, but who is struggling to find ways to adjust greenhouse gas emissions. The sixth is India which, like China, has vehemently protested limits on its emissions. Governments have promised to do what they would have done anyway. (2006)

The interest based explanation treats each country as an independent self-interested actor that seeks wealth and power by comparing the costs and benefits of different courses of action. Two factors the researchers looked at were ecological vulnerability and costs of pollution abatement. (Sprinz and Vaahitoranta 1994) Economic issues and climate change abatement have often been researched together because there is an obvious connection, “Although many researchers and policy-makers have advocated decoupling CO2 emissions from economic performance, so far the experience has shown that economic growth and CO2 emissions reduction still reflect two counteracting trends where responsibility for global climate change conflicts with economic priorities in a carbon-based economy.”(Shih-Fang 2010) Shih-Fang found that there is a difference in balancing economic growth with CO2 emissions, which in part explains the common but differentiated responsibility in Kyoto and developing countries resistance to implementing the same level of commitment expected from developing countries (2010)

Another issue regarding economic issues that climate change can bring about is the idea of double exposure to both globalization and climate change. States responding to the rapid changes that climate change and globalization face a unique set of challenges in implementing effective responses to climate change. “Climate change and economic globalization, occurring simultaneously, will result in new or modified sets of winners and losers. Double exposure has important policy implications, especially for those that are likely to experience the negative consequences of both globalization and climate change.” (O’Brien and Leichenko 2000) The important thing to note about the idea of double exposure is the idea of winners and losers and that the vulnerabilities that a state’s economy faces from globalization may appear to be more pertinent than the vulnerabilities that a state will face farther along from climate change.

Looking at past environmental successes is a large portion of the climate change literature. One international environmental treaty that had a large amount of success is the Montreal Protocol, which focused on phasing out the production of ozone depleting substances. The Montreal Protocol's success has been attributed to six factors, the role of scientific understanding of ozone depletion, the impact of public pressures on decision makers, the role of technological developments, and the leadership role of the United States, the epistemic community, and the role of international institutions. (Sprinz and Vaahtranta 1994) Sprinz and Vaahtranta argue that ecological vulnerability and economic capacity play a large part in a state's response to climate change, based upon the evidence that the EC or EU has played a larger role in cutting carbon emissions than the US. Sprinz and Vaahtranta's analysis of the implementation of the Montreal protocol places a heavy emphasis on the ecological vulnerability of states which is more difficult to do when it comes to issues of climate change because they were able to use incidence of skin cancer to measure ecological vulnerability, whereas in the area of climate change the idea of ecological vulnerability is greatly varied. One variable that they look at as having an impact is the successful development of substitutes for CFC's. This variable has also been attributed to the success of the EU cutting carbon emissions and being especially willing to participate in the Kyoto Protocol because they had recently discovered alternatives to fossil fuels (Foster 2002).

Other researchers in the climate change field have borrowed the success of the Montreal Protocol. One perspective looked at the carrot vs. stick approach to enforcing climate change agreements in developing countries. Zhang attributed the success of the Montreal Protocol to the fact that trade restrictions were accompanied by finance and technology transfer mechanisms, however there is a much greater cost in slowing climate change which means that industrialized

countries will not bear all the incremental costs of climate change mitigation. (2009). The economic issues regarding climate change are also much broader because CFC's were one area of production, whereas the causes of climate change can be considered to be capitalism and industrialization.

Another perspective on the interest-based explanation is the 5 stage model of helping. Frantz and Mayer applied this theory to environmental inaction in the US. The 5 stage model argues that in order for an individual to help one must notice the event in question, feel a personal responsibility to aid, know what to do, and decide to act. The researchers applied this model explain why individual citizens were not concerned about the environment and therefore there were little structural changes implemented. The issue of US citizens not noticing climate change can be explained because the effects are not spread evenly and the majority of US citizens spend their time indoors, away from regular interaction with the environment. Another issue that Frantz and Mayer put forward is the anti-science skepticism that is present within the US causes people to refuse to recognize climate change as a crisis. The authors explain the diffusion of responsibility in the context of climate change by the narrowly defined norm of responsibility in the US and the many parties involved in climate change. (2009)

There has been extensive psychological research about what would motivate a state or individual to take action against climate change. One factor that might increase participation in attempting to mitigate climate change is called the availability heuristic, "people and organizations that benefit from the development of law designed to remedy environmental problems might take advantage of the availability heuristic to raise public fear of environmental problems. These interests might create an "availability cascade," wherein publicity over an environmental threat leads to a groundswell of support for ameliorative regulation." (Rachlinski 2000) Although the

idea of the availability heuristic would lead one to think that the public would be proactive there are other psychological theories that argue that there is more motivation for people to do nothing about climate change. These are loss aversion and status quo bias, the rationale behind these theories is that people do not want to change the status quo for the worse and are reluctant to pay for reductions in risk, even though they do not tolerate increases in risk. Therefore Rachlinski argues that societies are more likely to take on the risks associated with not responding to climate change, than to take the sure loss of reducing emissions in order to reduce risk. (2000) The risk aversion most governments have to a sure loss could be fixed with an immense amount of public pressure, as happened in the US with an increase in environmental protection, “The historic success of publicspirited legislation supporting environmental protection suggests that the same might occur in the context of global warming as well. Such legislation, however, probably passed as a result of a groundswell of support for environmental protection” (Rachlinski 2000). Unfortunately on a macro-level as we become more distanced from nature people may feel less and less concerned about the adverse effects of climate change, or even about climate in general, or feel more capable in combating the effects of climate change, “An ever-smaller fraction of economic activity depends directly on the weather and climate; human capacity to adapt to changing weather, such as by building dikes and irrigation systems, has risen sharply in the last century and shows no sign of exhaustion.”(Victor 2006) Without a sense of risk or attachment to the environment, economic or otherwise, people are going to feel certain that the economic or lifestyle loss of cutting emissions is not worth it.

The idea of public support for enhanced regulation as well as the enthusiasm for cutting emissions in the EU led to the development of Kuznets Curve, which posits that there is an inverted U-relationship between pollution and economic development. Kuznets Curve was used

in the formation of the Kyoto protocol, which does not put limits on developing countries. There are three major explanations behind why more developed states regulate pollution more strictly, pollution damage becomes a higher priority once societies have completed basic investments, higher income societies have more technical personnel and funds for monitoring enforcement, and higher income and education empower local communities to demand higher environmental standards. The reliability and accuracy of Kuznets Curve has been called into question by researchers such as Dasgupta et. al who state, “It also seems likely that because of growing public concern and research knowledge about environmental quality and regulation, countries may be able to experience an environmental Kuznets curve that is lower and flatter than the conventional measures would suggest.” (2002) However, research done on Kuznets curve and deforestation demonstrates that there is some accuracy to the model. This is particularly interesting because while deforestation has a number of harmful effects on the environment one of the major effects is a large impact on climate change. Forests act as “sinks” for carbon emissions. One study found that states that had high levels of modernization, defined by education levels; democratization levels; and service sector activities led to a leveling off of deforestation or even reforestation in some cases (Ehrhart-Martinez et. al 2002)

Kuznets curve is part of a larger theory called “ecological modernization theory” which looks at environmental degradation as something that all industrializing countries go through and then deal with (Ehrhart-Martinez et. al 2002) There are several criticisms of Kuznets curve and ecological modernization theory because often when examined with more rigorous econometric methods the statistical and empirical evidence falls apart. One review argues that the only time Kuznets curve is possibly applicable is in the case of ambient pollution in urban areas, which has not been examined enough (Stern 2004). Several studies looking at both total ecological

footprints and ecological footprints per capita have demonstrated that there is no Kuznets curve when you examine the total consumption based environmental impacts. (Jorgenson, 2004; York et al., 2003; Jorgenson and Burns 2007)

An alternative to ecological modernization theory is the idea of a race-to-the-bottom scenario where high polluting firms move to states with more lenient environmental standards in high numbers, which then causes states with strict regulations to reduce them in order to hold on to the firms and help their economies, “In the “race to the bottom” scenario, relatively high environmental standards in high-income economies impose high costs on polluters. Shareholders then drive firms to relocate to low-income countries, whose people are so eager for jobs and income that their environmental regulations are weak or nonexistent. Rising capital outflows force governments in high-income countries to begin relaxing environmental standards” (Dasgupta et. al 2002) The race-to-the-bottom scenario would support the interest-based argument that states would not want to take a sure in loss in the face of an uncertain risk and give there jobs and industries to other states. It is important to note that there are other factors effecting which state a firm would choose to locate it’s industries and that there are things beyond state regulation that would cause a firm to self-regulate. A study done on firms in China that multinational ownership and multinational purchasers led to self-regulation by firms (Christmann and Taylor 2001). Also the race to the bottom theory predicts that by this point there should be a consistent increase all over in pollution, but the inverse is true as far as trends in particulate matter are concerned (Dasgupta et. al 2002).

Metabolic rift theory is another response to ecological modernization theory. Originally developed by Marx in the 1850’s to explain soil degradation metabolic rift theory argues that the major cause of any degradation to the environment is capitalist pursuit of profit, “The pursuit of

profit sacrificed reinvestment in the land, causing the degradation of nature through depleting the soil of necessary nutrients and despoiling cities with the accumulation of waste as pollution” (Clark and York 2005). Marx argued that a consistent interaction with nature acted as a “regulative law of social production” (Clark and York 2005) and that the distance from nature and agriculture most individuals experience in a capitalist society causes this metabolic rift which leads to the allowance of environmental degradation. Clark and York have used this theory to explain climate change by arguing that the purpose of capitalism is to expand, “As the economic system grows under capitalism, the throughputs of materials and energy increase and capital incorporates ever-larger amounts of natural resources into its operations.” The natural resources they are referring to are mainly petroleum and coal, the burning of which leads to CO₂ emissions. The lack of connection to the environment in these societies is the major cause of climate change and the reason why capitalism cannot be relied upon to stop climate change according to metabolic rift theory. The case that metabolic rift theorists point to is the United States’ lack of participation in the Kyoto Protocol. According to Foster, the reasoning given by President Bush for refusing to sign on to Kyoto was, “The Kyoto Protocol itself, he said, was flawed for two reasons: (1) it “would have a negative economic impact [on the U.S. economy] with layoffs of workers and price increases for consumers” and (2) it did not include developing countries like China and India, both of which are among the largest contributors to global warming.” (Foster 2002) Thus the United States’ major concern was not about any sort of scientific uncertainty about the causes of climate change, but about the economic disenfranchisement the United States would experience by being forced to cut carbon emissions while other countries that were dependent on fossil fuels did not. This agreement was seen as a threat to the economic competitiveness of the US. The metabolic rift school of thought also

explains the EU's willingness to participate in Kyoto by the fact that states within the EU had already developed alternatives to fossil fuels or had traditionally not been as dependent on them (Foster 2002).

One of the major premises of metabolic rift theory is the idea of the "treadmill of production", which is that in capitalist society producers must expand production in order to maintain profits. One study done by Jorgenson and Burns looked at changes in consumption based ecological footprints from 1991-2001 and factors that could affect this including economic development, export dependence, level of urbanization, manufacturing intensity, services intensity, agriculture intensity, domestic income inequality, and state environmentalism. The results of this study were that a higher economic development, manufacturing intensity and services intensity had a positive correlation with ecological footprints, while export dependence had a negative correlation with ecological footprints. The other factors had no impact. This study was done using data from 2001 on 138 countries (2006). The results of this study support metabolic rift theory, especially the treadmill of production component.

Theory

Looking at why a state had a decrease in CO2 emissions can help explain what sort of action should be taken in order to motivate other states to decrease their emissions as well.. Within the literature there are 4 major themes being played out to explain variations in response. There is the idea of risk and adaptation, which draws heavily on the success of the Montreal Protocol and psychology; there is Kuznets curve and ecological modernization theory, which is arguing that the environment will become a priority once states overcome the initial challenges of industrialization; race to the bottom theory where states will actually loosen environmental regulations in order to remain competitive; and metabolic rift theory, which argues that the

inherent attributes of capitalism lead to production continuing to expand and humans continuing to distance themselves from nature thus losing concern about environmental degradation.

Because of the Law of the Least Ambitious Party and the research in the literature that argued that even if they signed Kyoto states acted as they would have without the international treaty I am going to use the state as my level of analysis. Borrowing from the research done on the success of the Montreal Protocol I am going to look at country level variables that can demonstrate if there is something that was present in the area of ozone depletion that is lacking in the area of climate change that has hindered countries' responses. One factor was the role of the scientific certainty that CFC's were causing ozone depletion as well as the ease of quantifying risk by using skin cancer. I would argue that one of the major differences between ozone depletion and climate change is the idea of quantifying vulnerability. Even though there is scientific consensus regarding that climate change is happening, the exact predictions can be varied. One way to quantify vulnerability would be to look at the amount of agriculture within a state, because agriculture is one area where you cannot completely climate proof yourself. I am going to argue that if a state has a larger amount of arable land then they will feel more vulnerable and have taken action.

A factor that would hinder a state from cutting back on CO₂ emissions is their economic advantage because as many theories and studies have shown the higher a state's GDP the higher their CO₂ emissions. I am going to look at GDP per capita because GDP as a single factor has already been tested and shown to be statistically significant multiple times and I think that it is important to control for the size of the population in order to see if it is truly how rich a state is or if a state has a large GDP and a huge population, so it could be the amount of people living and emitting within the state that are causing these high emissions.

Although Kuznets curve and ecological modernization theory have been generally disproven it has important policy implications because it was relied upon in the development of the Kyoto Protocol especially in regards to giving developing countries a chance to catch up in terms of development and then work on fixing the environment. I decided to look at Kuznets curve from a less economic approach and more from another area where Kuznets curve is used, which are social welfare programs. My proposal is that if a state has reached the point in development where they are ready to invest heavily in education and healthcare, both of which are social welfare programs beyond basic development then according to ecological modernization theory, they should also be ready to cut back on CO₂ emissions and develop alternatives.

I will be looking at GDP per capita because the economic status of a state has demonstrated a large impact on what if any action is taken regarding CO₂ emissions. The race-to-the bottom theory is one that does not hold much weight because there are so many other variables regarding where industries choose to build their plants. Also it has been thoroughly researched and there is not much evidence that it is happening, because by now there would be states reducing their environmental regulations. One reason that the race-to-the bottom argument would fail could be because once states look over all the uncertain risks and the sure losses they face by enforcing regulations and then decide that environmental regulation is still important enough to pass they are going to be committed to keeping those regulations in place. Therefore I will not be including the race-to-the bottom theory in formulating my hypotheses.

Metabolic rift theory is a theory that requires more rigorous statistical analysis, the arguments about the distance from nature and environmental degradation that is caused by capitalism's need to constantly expand exponentially have been laid out very thoroughly.

However there are states that have a strong connection to agriculture and their environments and the impacts of climate change, or even the simple environmental waste and degradation often caused by industrialization could be displeasing enough to cause a reduction in environmental degradation. I am going to hypothesize that states with the most arable lands are going to be more likely to be proactive in responding to climate change while states that are highly industrialized will feel that they can “environment proof” themselves and will be the least proactive.

Methods and Hypotheses

H1: If a state has more arable land then it will have less CO2 emissions

Because of metabolic rift theory if a state has more arable land then they will be connected to the environment and therefore more concerned about greenhouse gases and they will also feel more at risk from CO2 emissions which would cause them to be more proactive in cutting back

H2: If a state has higher health care expenditures then it will have less CO2 emissions

A more educated populous was one of the reasons given for the success of the Montreal Protocol so I am going to look at education expenditures to see if a state that spends more on education tends to have less emission.

H3: If a state has higher education expenditures then it will have less CO2 emissions

Both H2 and H3 have to do with the Kuznet's curve idea that once states have developed enough then they will become concerned about social welfare including the environment. Since every study I've read on Kuznet's curve has had mixed results using the economic stability as the independent variable I am thinking that other forms of social welfare spending might be a more effective type of measurement in where they were in their development.

H4: If a state has higher GDP per capita then it will have more CO2 emissions

A lot of the articles I read tied economics to emissions by using a rough measure of GDP or even the US as an example so I'm trying to control for population because a highly populated state would emit more CO2's than a less populated state because there would be less people using resources.

Using open source data of indicators from the World Bank and the CIA world fact book I will run a linear regression on each of my hypotheses using data from 1990 for a control variable and data from 2006 as a test variable. I chose 1990 as my control variable because although in the scientific community climate change has been observed for a long time in the literature I have read it appears that the wider international community first began taking an interest in climate change around then. I chose to use the 148 countries that had data available for all of the variables I was looking at. I chose to use metric tons per capita to measure for the CO2 measurements in order to control for population size. I also used GDP per capita for the same reason.

Results

SUMMARY OUTPUT 1990

<i>Regression Statistics</i>	
Multiple R	0.388988353
R Square	0.151311939
Adjusted R Square	0.127572413
Standard Error	5.460893307
Observations	148

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	760.3061853	190.0765463	6.373839881	9.50741E-05
Residual	143	4264.453867	29.82135571		
Total	147	5024.760052			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0.43102321	1.969839531	0.218811331	0.827109003	3.462743161	4.32478958
Arable Land	-	0.020238573	-	0.010532881	-	-

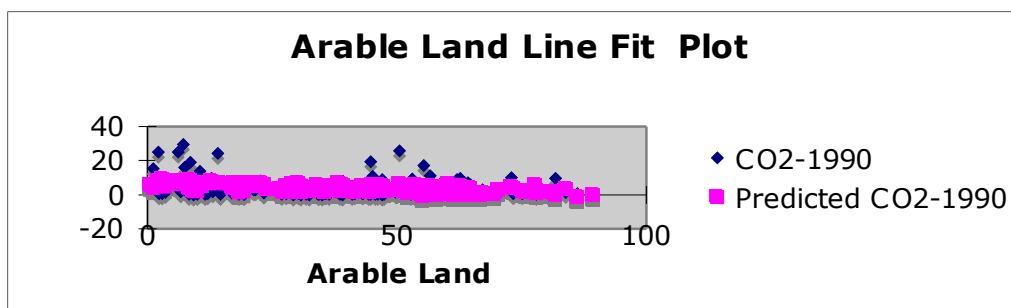
	0.052457913		2.591976931		0.092463341	0.012452485
Health Expenditure	0.092745259	0.023683271	3.916066243	0.000138879	0.045930722	0.139559796
Education Expenditure	0.048374136	0.190975815	0.253299803	0.800400339	0.329126262	0.425874534
GDP/Capita	-7.8829E-06	2.77127E-05	0.284450941	0.776476321	-6.26623E-05	4.68965E-05

SUMMARY OUTPUT 2006

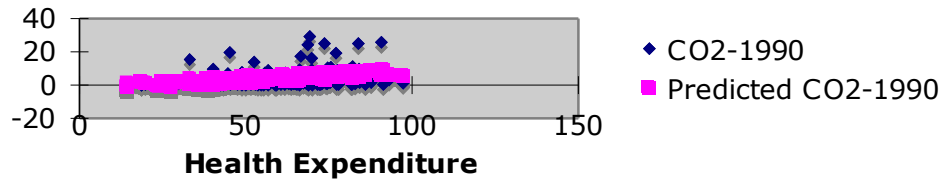
Regression Statistics	
Multiple R	0.406791031
R Square	0.165478943
Adjusted R Square	0.142135697
Standard Error	6.555069584
Observations	148

ANOVA					
	df	SS	MS	F	Significance F
Regression	4	1218.417391	304.6043477	7.088943017	3.09779E-05
Residual	143	6144.558027	42.96893725		
Total	147	7362.975418			

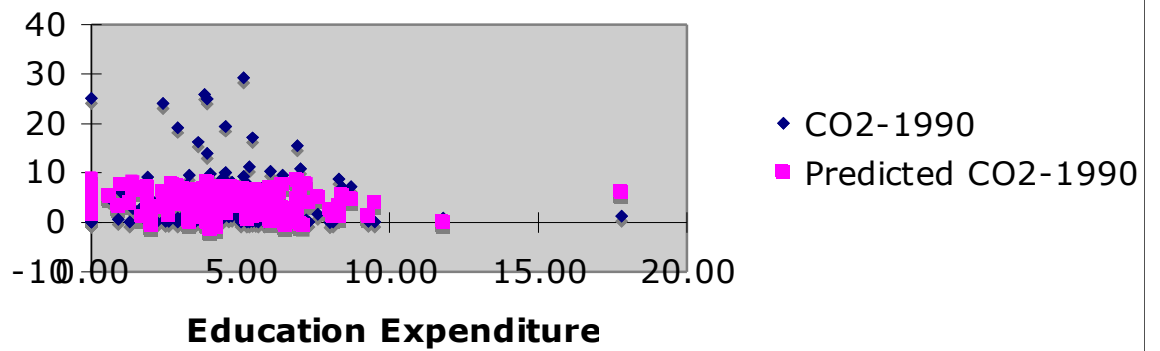
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	2.674597066	2.364528012	1.131133593	0.259892293	-1.999346933	7.348541065
Arable Land	0.079980085	0.02429369	-3.292216351	0.001252446	-0.128001232	0.031958937
Health Expenditure	0.099419572	0.028428589	3.497168732	0.000626837	0.043225003	0.155614142
Education Expenditure	0.094654036	0.229240838	-0.412902156	0.680296741	-0.547792605	0.358484533
GDP/Capita	-2.26717E-05	3.32654E-05	-0.681540185	0.496632031	-8.8427E-05	4.30837E-05



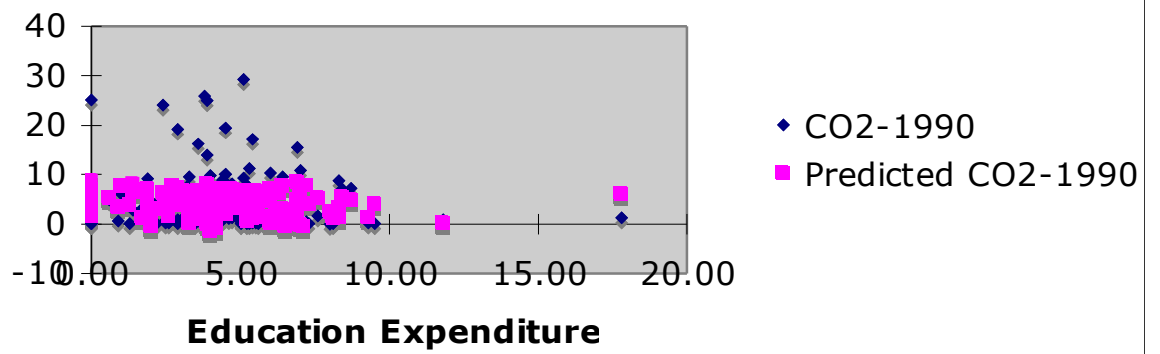
Health Expenditure Line Fit Plot



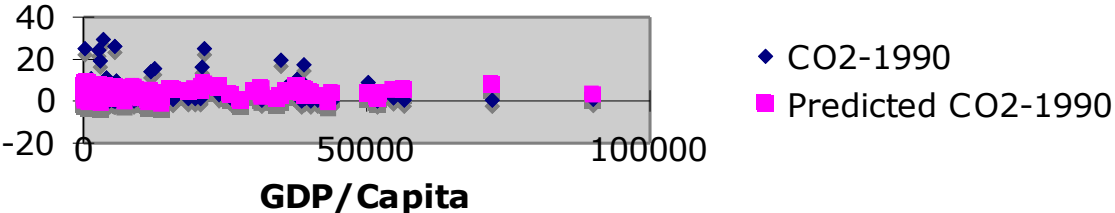
Education Expenditure Line Fit Plot



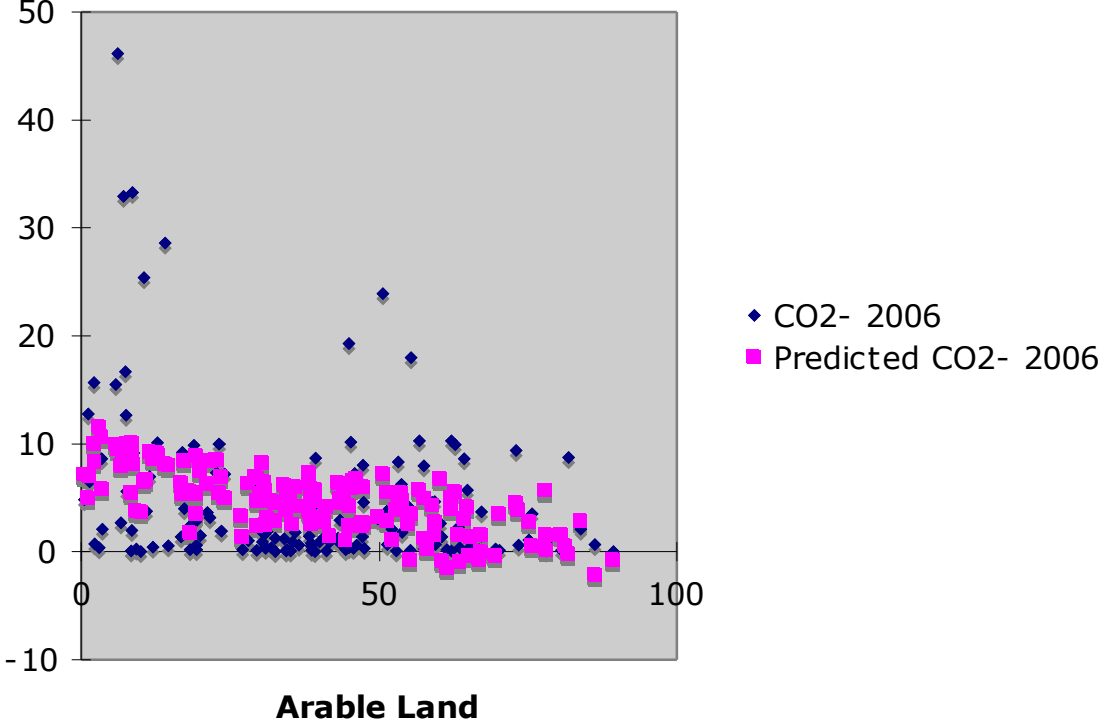
Education Expenditure Line Fit Plot



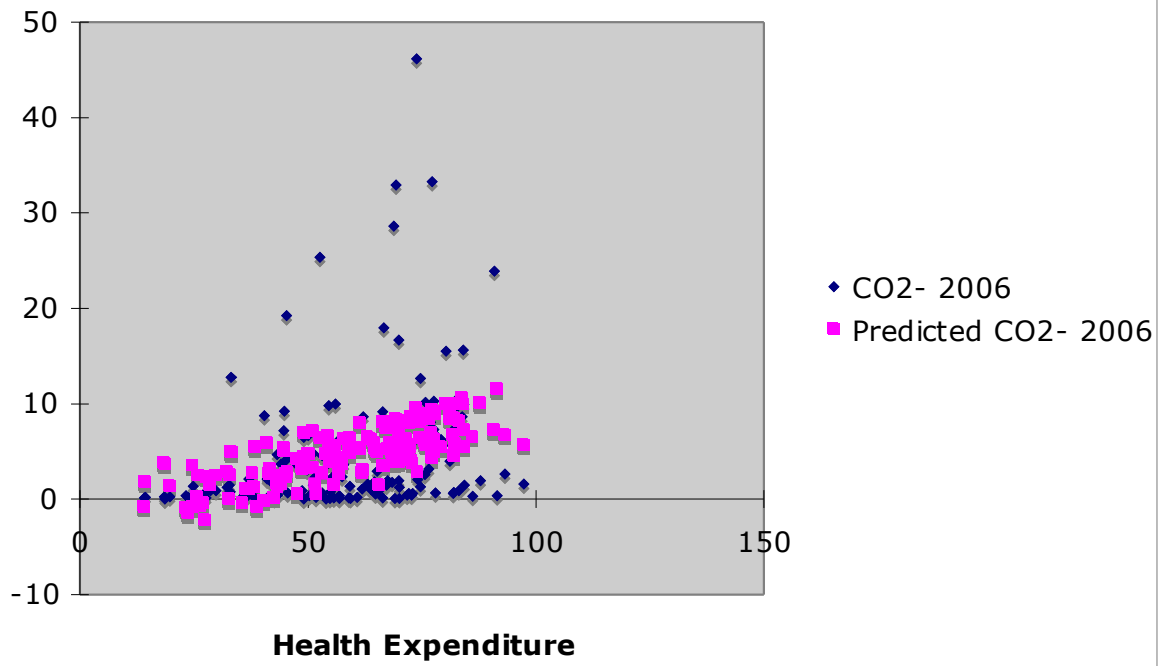
GDP/Capita Line Fit Plot



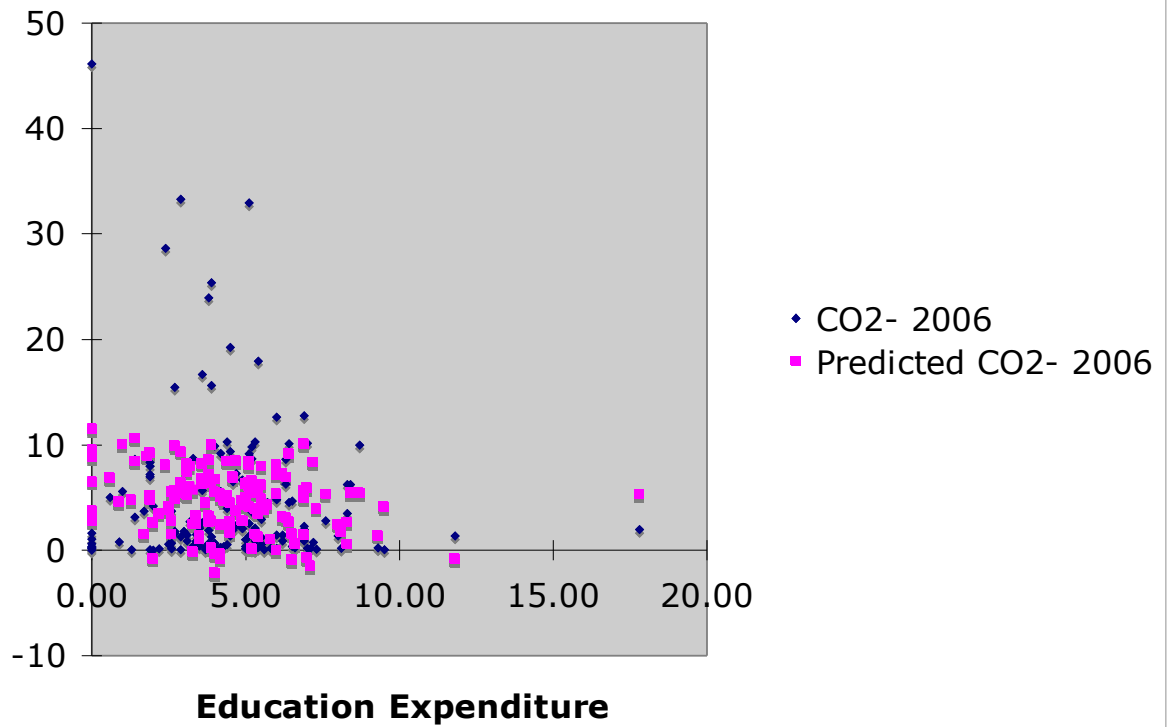
Arable Land Line Fit Plot



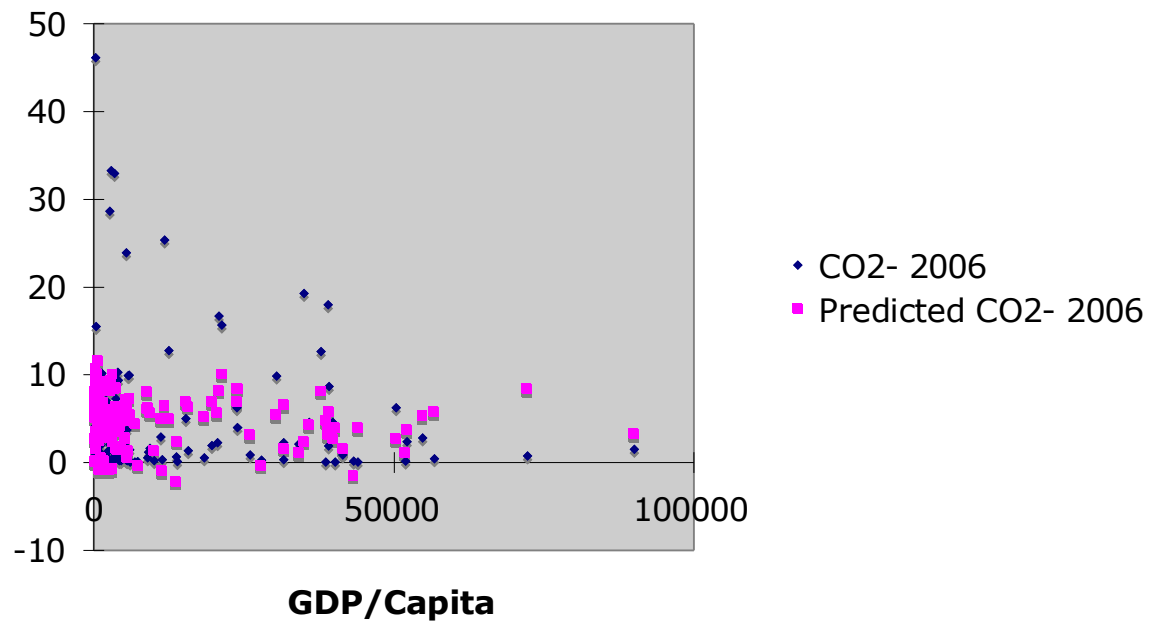
Health Expenditure Line Fit Plo

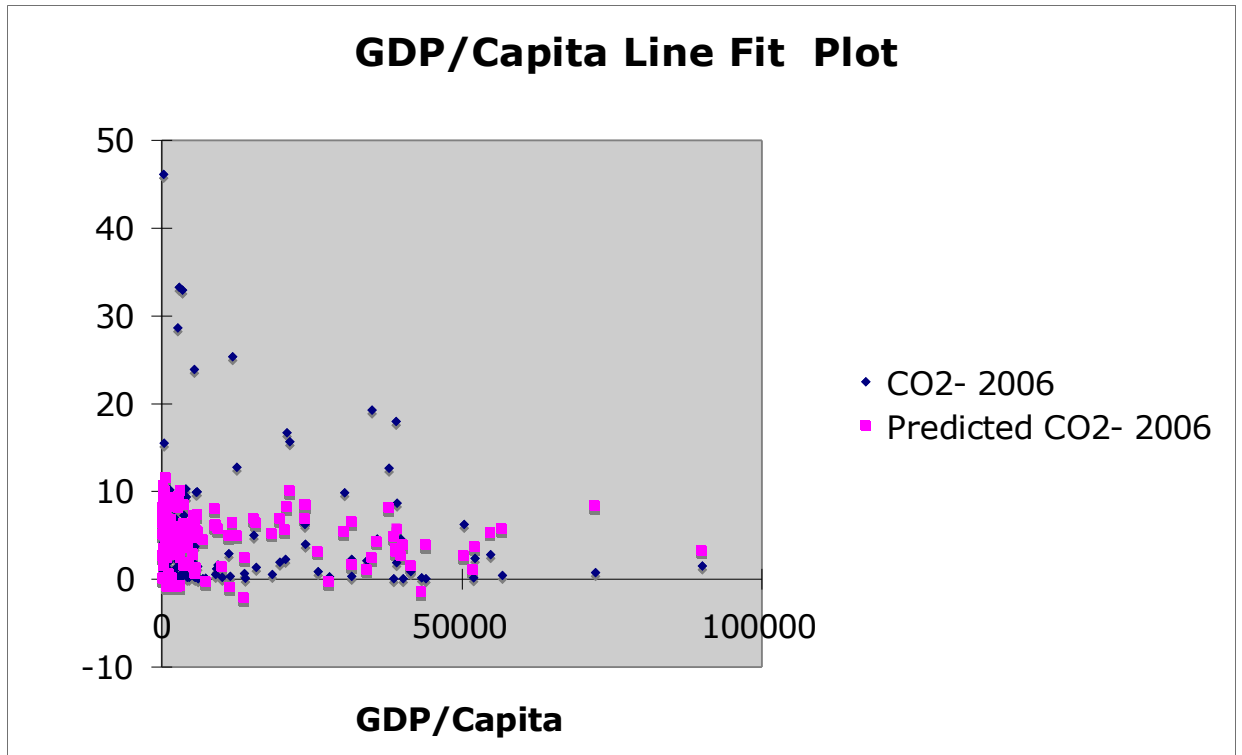


Education Expenditure Line Fit Plot



GDP/Capita Line Fit Plot





Conclusions

This type of analysis supported none of my hypotheses. Although there was a p-value in multivariate regressions for some of the variables there was very little change from the control variables. The first hypothesis had to do with the idea of risk and vulnerability leading to climate change adaptation. I was attempting to use agriculture as the factor for being vulnerable the way that skin cancer had been used in CFC regulation. This had been discussed in the literature a lot but had not been tested. One suggestion for further research would be to look at scientific models that the state leaders' have been informed about and use them to see if they are responding after being told by science that they are at risk, instead of looking at the passive knowledge of risk to agriculture. I think that the failure of this hypothesis demonstrates that there is a lack of

scientific certainty about climate change; because there are various complex models about what might happen and who the winners and losers of climate change might be it is difficult for a state to truly feel that their economy or the quality of life of their people are at risk. This is why the “tragedy of the commons” is such a large component of climate change research and advocacy. Another issue that I did not examine but might have something to do with the lack of state response could be the idea of climate change adaptation, especially geo-engineering which might make states feel more comfortable continuing on the same industrialization path because they feel that when the consequences of climate change become more serious science will be prepared to adapt.

My second two hypotheses were looking at development of infrastructure and the Kuznets curve argument that once a state becomes developed enough to move past the basic issues of industrialization they will develop sound environmental and social welfare policies. This was not the case in my analysis and with Kuznets curve already being harshly criticized from an econometric stands point these results were somewhat expected. Even former President Bush’s using economic concerns as an explanation for the US refusal to sign the Kyoto Protocol demonstrates that hyper-developed countries do not become comfortable enough in the stability of their economy to take sure losses in order to avoid an uncertain risk.

My final hypothesis was looking at GDP per capita to see if a state that was wealthy even when controlling for population tended to emit more CO₂, these results were also inconclusive. But with the costs of cutting CO₂ emissions as well as CO₂ emissions already being associated with higher GDP there is clearly some sort of correlation and I would argue that it probably has to do more with the type of economy than how rich a state is. This would support metabolic rift theory and the idea of the treadmill of production. There is a need for more rigorous statistical

tests about on the types of economies and how that impacts emissions. Case studies would also be effective in examining metabolic rift theory by comparing the rhetoric of state governments to see if they are prioritizing their GDP over the environment as well as looking at how many people within a state feel at risk from climate change or concerned about the environment in order to see if distance from nature and weather in modern society truly exists and if that's what is leading to environmental degradation.

Although none of my results were conclusive it did fill a gap in the research while raising questions for more rigorous tests. I think further research should rely more on looking at the different types of economies in order to go beyond the basic GDP tests as well as do several case studies looking at the actors within states that have responded differently to climate change. Climate change is a huge and expensive issue, whether you are looking at mitigating it or adapting to it, so it actually makes sense that there is no simple explanation to why some states respond while others do not.

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