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Economics of Carbon Regulation: An Exploration to the Nuance of Carbon Regulation

Timothy J. Schwartz
Fordham University, envstudies11@fordham.edu

FORDHAM ENVIRONMENTAL POLICY

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This dissertation is written for the purpose of understanding the complexities and issues involved with greenhouse gas regulation. It explores the economics of international and local policies and would be valuable in aiding the common American on the current state of affairs.

Introduction

Greenhouse gas emissions are threatening the foundations of global society; human health, the global economy and international peace are all at risk. America has a responsibility to ensure that climate change and the effect of greenhouse gases do not allow this chaos to happen. Choosing the correct policy can be difficult. America must create strong environmental policy that is crafted with cost-benefit analysis so that it may effectively participate in an international climate agreement.

Before further discussing economic evaluation tools it is important to examine the science behind environmental policy. This policy is in dire need because of the rapid warming of the earth. Some critics have claimed that our current climate change is just another cycle that has been happening for billions of years, however evidence shows that current warming trends are not only occurring at an alarming rate, but they also contradict some science which has projected we should be in a cooling period. This science is important in establishing why environmental policy is both topical and urgent.

America has combatted environmental hazards in the past. There is currently a battle over the how stringent and urgent environmental regulation should be, and who the best arbiter of that legislation is. The EPA has been mandated by the people and courts to do something about the hazards resulting from global warming; this is not a popular idea. Congress is now in a scramble to legislate before the EPA can regulate. The foundations of a good policy are in place but certain details require further evaluation to determine what the final policy will look like and what the resulting effects will likely be. That is where cost-benefit analysis (CBA) comes in.

Cost-Benefit analysis has traditionally been used to support conservative anti-regulatory policy. All cost-benefit analysis models require baselines that serve to guide the operations of the functions through the changing patterns. Many important baseline factors are regularly ignored when doing CBA. They are often the markets that have the highest costs. Different approaches to CBA will yield different results. When focusing on the American economy and only using national statistics climate legislation looks like a bad idea. Factoring in the costs that would fall onto the global community creates a situation where CBA has highly desirable outcomes.

An international treaty is yet to be signed that has any type of enforcement. The Montreal Protocol of 1987 was incredibly successful so global action is possible. All other nations of the world were able to come to an agreement at the Kyoto Protocol but the world's largest polluter did not sign on. America is not likely to sign any international treaty until they have come up with a domestic policy that will allow them to meet their commitments. Establishing a domestic environmental policy that limits America's contribution to global warming will result in increased wealth as proven by cost-benefit models.

The goal of environmental policy is to create maximum consumer and producer surplus. Currently the system of production and consumption does not account for all of the costs involved. Environmental policy creates ecological and economic integration that fixes the costs of goods to the true total cost of production. Cost benefit analysis serves as a tool determine this actual cost of production and show policy maker's efficient options to bring existing costs into line with actual costs.

Chapter 1

History of Climate Change

For the earth's 4 ½ billion year history the climate has been adjusting based on slow geological and astronomical cycles. Conversely, current observations in our climate are trending towards very rapid temperature increases. Some "climate models show that a doubling of pre-industrial levels of greenhouse gases(GHG) commits the earth to a rise of between 2-5 degrees Celsius in global mean temperature between 2030 and 2060"[1]. The amount of heat stored in the Earth's atmosphere is a process that has been in flux throughout the history of the earth, but it is becoming clear that humans are responsible for modern trends.

The basic science behind climate change deals primarily with the earth's relationship with the sun. The earth is warmed by infrared radiation (IR) in the form of sunlight. A balance of Earth's temperature is kept because a large part of this radiation is reflected off of the earth. Things in the lighter part of the color spectrum like, white rooftops, glaciers and beaches, reflect away a larger part of infrared radiation. Things

[1]Stern, Nicholas. The Economics of Climate Change. Cambridge: Cambridge University Press pg 3

in the darker part of the spectrum like, black tops, oceans and plants (plants use IR for photosynthesis)[2] absorb infrared radiation. Reflected IR must travel through the different levels of the atmosphere back towards space. In this travel is must pass through the air which holds GHG. GHG like Methane, Carbon Dioxide and Black Carbon held specifically in the troposphere.

Additionally, this current warming trend is alarming and merits studies because predictions based on pre-industrial climate composition and earth core sampling suggests that the Earth should be going through a cooling trend[3]. The most comprehensible climate model comes from Milutin Milanković. Using the concepts of precession (change in orientation of the Earth's rotational axis), obliquity(change in axial tilt) and eccentricity (shape of earth's orbit around the sun)[4] he calculated the amount of sunlight was getting to Earth and was able to explain long term glacial trends that are clues to where Earth's climate is heading[5]. Given that the Earth is supposed to be slowly cooling continued climate change studies remain vital to human understanding of the planet[6].

Accredited scientific institutions have been able to come up with many concrete findings about climate change, why current trends are occurring and what the future holds. One of those groups, The United States Global Change Research Group (USGCRG), an alliance of thirteen government agencies, came to a conclusion that emphasized simple to understand language that was purposefully written so that it could be of utility to policy makers. One USGCRG goal being that their environmental

[2]Gore, Al. Our Choices New York: Rodale pg 22
[3]Weart, Spencer. The Discovery of Global Warming Cambridge: Harvard University Press pg 18
[4]NASA Websitehttp://earthobservatory.nasa.gov/Features/Milankovitch/milankovitch_2.php
[5]Weart, Spencer. The Discovery of Global Warming Cambridge: Harvard University Press pg 50
[6]Lecture Stoll, Steven 20, April 2010

conclusions could be used to enacted a program of some sort by the United States Government to mitigate the truly devastating predications about the our future. The most important conclusions that could inform future policy creation were the first three headlines:

- Increased global warming is caused by humans
- Climate changes are underway in the United States and are projected to grow.
- Widespread climate-related impacts are occurring now and are expected to increase.

These conclusions are based on scientific evidence and are supported by multiple groups around the globe including the IPCC. Determining that climate change exists is science. Determining whether it is a good or bad thing for humans becomes a social science. The IPCC and USGCRG are both groups that do incredible research into what is happening on our planet. However, those groups of scientist must hand the reigns over to policy makers, economists and other social scientists to determine what humans will do with this scientific knowledge.

The Stern Review, one of the premier works on climate change economics , predicts that business as usual could result in as much as 5%-20% loss of GDP over the next two centuries[7]. The economics to support proactive environmental policy exist. Yet, the scale and complexity of this issue makes it incredibly difficult for policy makers to understand the complexity of the inter-connected global system. For example, the term global warming implies that the only thing occurring is a rise in temperature. Misconceptions including the idea that "global warming will make my environment better so it must make the whole world better off" form around the realities of what is

[7]Stern, Nicholas. The Economics of Climate Change. Cambridge: Cambridge University Press pg 162

happening. The more complete way to understand the anthropogenic changes that are occurring would be to view the modern environmental issues as climate change. Understanding how the changes in the system are going to affect an individual's life often means breaking down changes into predictions about different comprehendible parts; some of those issues include increased desertification, heat waves, areas with heavy rainfall and sea-level rise.

Modern economies to date have forgotten some basic principles of economic. The Polluter Pay Principle has been highly ignored during the past decade and a half. The idea was originally proposed by Arthur Pigou that a tax should be levied on each unit of pollution or emissions output and that tax should equal the marginal damages caused to the economic system b that pollution[8]. American policy should also look uphold a Pigovian taxes. This would address the issues of excess waste and unsustainable growth that are built into the American economic system. All environmental policy is written with this issue as an underlying principle.

Chapter 2

AMERICA'S OPTIONS FOR CURBING GREENHOUSE GAS EMISSIONS: REGULATION OR LEGISLATION

There are two ways in which the United States could combat greenhouse gas (GHG) emissions: either by using the existing power of the Clean Air Act (CAA) to

[8]Rao, P.K. The Economics of Global Climatic Change Armonk: New York pg 87

regulate emissions with the Environmental Protection Agency (EPA), or by creating legislation in congress that reduces GHG . There is controversy, however, over which governmental agency should be the major enforcer of GHG emission standards. The two main governmental bodies vying for regulatory control over GHG are the executive branch's EPA, under CAA guidelines, or congressional oversight with a newly crafted piece of legislation. Regardless of who has authority over GHG regulation, what is clear is that in the immanent future GHG control will be required. Enacting a policy that is healthy for the economy and to the citizens of the United States, as well as the planet, requires an acute perspective.

While Congress has not yet received an obvious mandate from the American citizenry to act on the climate change issue, the United States government is moving forward on the issue. The stated goal of the Clean Air Act (CAA) is "to protect public health and welfare from any actual or potential adverse effect which in the Administrator's judgment may reasonably anticipate occurring from air pollution or from exposures to pollutants in other media, which pollutants originate as emissions to the ambient air[9]." Action to mitigate GHG has already been required by the Supreme Court; in the case of Massachusetts vs. the EPA 2006 the Supreme Court ruled against the EPA; establishing that GHG was actually parts the EPA's jurisdiction. In the case, Massachusetts made the claim that the EPA was responsible for controlling GHG because of devastating effects the emissions were having on Massachusetts' citizens health and property. EPA's counter argument was that the Clean Air Act was not meant to refer to carbon emissions in the section giving the EPA authority to regulate

[9]Holiday, Scott. Schwartz, Jason. The Road Ahead: Integrity Policy Institute Policy Brief. pg 9

"air pollution agents."[10] Their secondary position was that even if they were responsible to regulate GHG now would not be the time. There is too much uncertainty to make a decision.

The Supreme Court decided that the Act was written intently be sweeping and broad language so that it could be all encompassing. They voted in a 5-4 decision in favor of Massachusetts. There were three major arguments made by the Massachusetts that now had to be accepted by the EPA;(1) The definition of "air pollutant" in the Clean Air Act includes greenhouse gases; (2) any justification not to regulate must "conform to the authorizing statute"; and (3) that "the harms associated with climate change are serious and well recognized." [11]

During the Bush administration Massachusetts vs. the EPA was generally ignored because of President Bush's anti-regulatory reputation. The first real action taken since the Supreme Court's decision was a signed endangerment finding, spearheaded by Lisa Jackson, under President Obama's administration. An endangerment finding proposes that new pollutants are dangerous and come under the jurisdiction of the EPA. In April 2009 it was "(found) that air pollution of the six GHGs is reasonably anticipated to endanger both public health and welfare.[12]" The EPA is now responsible for the control of GHG under the CAA.

There were many that oppose the idea of the EPA regulating GHG. The view held by lobbyists, Scott Segal from Bracewell & Giuliani, and Sam Thernstrom of the

[10]The Oyez Project: Mass vs EPA <http://www.oyez.org/cases/2000-2009/2006/2006_05_1120>
[11]United States. Environmental Protection Agency. Advance Notice of Proposed Rulemaking: Regulating Greenhouse Gas Emissions under the Clean Air Act. http://www.epa.gov/climatechange/anpr.html
[12]Holiday, Scott. Schwartz, Jason. The Road Ahead: Integrity Policy Institute Policy Brief pg 15

American Enterprise Institute is that EPA regulation should be stopped. They believe that congress is working on legislation and that having both Congressional Acts and EPA Regulation would be excessive, confusing, and economically, a bad idea[13]. As of April 22nd 2010 EPA regulation has been deferred. The EPA has taken important first steps in the policy making process which will hopefully continue to expand. The first step taken Lisa Jackson was to account for the amount of GHG that were being emitted and where those emissions were coming from.

In 2011 the reporting of CO2 and CO2 equivalents to the EPA begins. CO2 equivalents are an amount of greenhouse gases that contribute to global warming as much as a ton of CO2. The first round of information will be obtained from stationary sources; producers that emit 25,000 tons of CO2 or more, and car engine manufacturers. As time passes more polluters will be required to report their data.

The second step in the regulatory process is evaluating what types of pollutants are being emitted. The regulating for a stationary source has two classifications, criteria pollutants and hazardous pollutants. Criteria pollutants are emitted in large quantities and cause problems in many regions of the country. Hazardous pollutants are highly toxic in small quantities and are much more numerous than criteria pollutants. In 1990 the CAA was amended and requires the EPA to set National Ambient Air Quality Standards (NAAQS). The NAAQS are a more detailed version of CAA pollutants. These standards have the primary goal of protecting human health and the secondary goal of protecting human welfare including "including protection against decreased

[13]Mulkern, Anne. "Green Groups Fight to Keep EPA's Power over Greenhouse Gas Emissions" New York Times 6 April. 2010

visibility, damage to animals, crops, vegetation, and buildings"[14].

The NAAQS regulate criteria pollutants, the large quantity emissions. GHG qualifies for the NAAQS for two reasons; first because the pollutants are present in the ambient air quality, this is based on the court ruling that GHG is present in all atmospheric levels and second that GHG is a result of "numerous or diverse mobile or stationary sources". Before the ruling of MA vs. the EPA and the subsequent endangerment statement the EPA only regulated six criteria pollutants: ozone, particulate matter, carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead. The GHG that was determined by the EPA to be detrimental should now be regulated by NAAQS. The EPA's expanded responsibility can be used to enforce regulation or spur congress to take action.

EPA regulations are not the preferred control method, especially compared to some of the other options available through congressional legislation. But if congress fails to act in the near future, which seems likely given the current focus on immigration reform, EPA regulation may become necessary. The President stated that a nationwide energy plan is necessary and if congress fails to act the executive branch of the government could assume power. The White House position is that "We must take immediate action to reduce the carbon pollution that threatens our climate and sustains our dependence on fossil fuels. After decades of inaction, we will finally close the carbon pollution loophole by limiting the amount of carbon polluters are allowed to pump into the atmosphere.[15]"

[14]National Ambient Air Quality Standards <http://www.epa.gov/air/criteria.html>
[15]Official Opinion of the White House: Energy & Environment <http://www.whitehouse.gov/issues/energy-and-environment>

While congress has not taken up GHG emission reduction legislation business industries fears about EPA regulation and constituent fears about the realities of Climate Change may force Congress to act more quickly. The two most commonly discussed paths to regulate the amount of GHG that enter the atmosphere are a carbon tax or a national cap and trade system. A carbon tax is one of the simplest methods of controlling climate change. It levees a tax on the use of all carbon from the source. Coal, oil, and natural gas would become more expensive. However, a carbon tax does not necessarily specify a particular number of carbons released into the atmosphere, and therefore may not actually reduce GHG. A carbon tax essentially puts the burden of reduction on the consumer because it relies on the premise that an increase in price on the supply will reduce demand. The price that regulates carbon has been studied, but modeling the U.S economy can be very complicated often results vary, and decreased GHG is not completely guaranteed.

A cap and trade system would set a specific amount of carbon dioxide is allowed to be emitted into the atmosphere, the "cap". Credits would be distributed in carbon tons and would have to be returned to the government by polluters for each ton the emitted. The total amount of credits would be decided by the government and the government would decide how the credits are distributed. The ways that credits are distributed in a cap and trade system can have profound effects on the total cost of the legislation and profits can be used to offset costs that are imposed on different economic classes.

The United States has used the cap and trade system in the past. In the 1980's the entire United States, particularly the Eastern United States, had problems with acid

rain destroying buildings and kicking up particulate matter resulting in health issues[16]. It was determined that acid rain was being cause by the large amounts of sulfur dioxide and nitric oxide gases and resulting particulates that was being released into the atmosphere by the mining and burning of sulfurous coal from the Appalachian Mountains. The United States created a cap and trade system for the emissions of sulfur dioxide in 1990(H.R. 2454).

The inclusion of "trade" in the cap and trade program allowed firms to take full advantage of the allowance trading market and banking feature and helped to make the cap and trade program so successful. Banking credits allows firms that have extra credits to save for a later date. This works as an investment in the program. Firms wanted to keep up the value of their banked credits by limiting supply and therefore increasing the SO2 reduction. The trading feature allowed for firms to have unique solutions to their emissions problem. There were dramatic reductions in the delivery price of low-sulfur coal and improvements in performance scrubbing; scrubbers are flue gas desulfurization equipment. The program ran in two phases, beginning in 1995, the second phase starting in 2000. By 2001 the program had reduced SO2 to 40% of the 1980's levels. Sulfur dioxide, acid rain is no longer a problem as a result of the cap and trade program and total sulfur dioxide emissions remain at very low levels. The cap and trade model, used to reduce sulfur dioxide, is one of the primary options available to proponents of carbon dioxide reduction.

Environmental bills to regulate GHG were have been introduced and failed in the past. John McCain and Joseph Lieberman introduced a piece of legislation,

[16]Burtrow, Dallas. Choosing Environmental Policy District Columbia: RFF Press Book pg 42

Climate Stewardship and Innovation Act, in 2003 the four pollutant cap and trade approach that limited the emissions of "carbon dioxide, sulfur dioxide, nitrogen oxides, and mercury[17]". It covers cover electric power production and petroleum for the industrial, commercial, and transportation sectors which represents more than 70% of all emissions. The bill did not include agricultural or home produced forms of GHG. The Climate Stewardship and Innovation Act specified a cap on entities producing more than 10,000 tons of carbon emissions per year. Resources for the Future, non-profit, non-partisan research group, estimated that the cost for a ton of carbon would equal about $14[18] in 2010. The results of a cap policy would dissuade the use of coal heavily because it would cost an additional $32 for a short ton of coal. The cost of using gasoline would increase 9 percent. A shortcoming of this policy was that methane and nitrous oxide were not included. Methane and nitrous oxide are the largest secondary sources of global warming and their release is projected to increase in the following decades, failing to cover these emissions would be foolish and nearsighted. A clear upside of the bill would be that the government would be sending a message to the private sector those carbon emissions will be more costly in the long run. The role of government in this case is to help the private sector to move towards smart socially responsible investments. This economic shift also bolsters investment in carbon sequestration and capture technology as well as helps shift the economy to clean energy technologies like solar, wind, geothermal, nuclear and hydroelectric. This Climate Stewardship and Innovation Act were ultimately defeated by the Senate with

[17]Kopp, Raymond. Summary and Analysis of McCain-Lieberman – "Climate Stewardship Act of 2003 <http://www.rff.org/News/Features/Documents/McCain-Lieberman.pdf>

[18] Kopp, Raymond. Summary and Analysis of McCain-Lieberman – "Climate Stewardship Act of 2003 <http://www.rff.org/News/Features/Documents/McCain-Lieberman.pdf>

a vote of 55-43. The structure of the McCain-Lieberman bill lives on in Title III of the American Clean Energy and Security Act.

The leading contender for an American energy and economic policy has already passed through the House of Representatives. The American Clean Energy and Security Act, proposed by representative Henry Waxman and Edward Markey, passed in the house with a vote of 219-212, and 3 not voting. This bill addresses GHG with a cap and trade system. The difference between this bill and the 2003 bill are; the amount of amenities addressing energy issues, such as electric vehicles and ways to increase their manufacturing and powering capabilities, building standards and government electrical requirements. The bill gives strict outline about how the EPA administrator is to enforce the American Clean Energy and Security Act.

The term Cap and Trade has two major parts emphasized in Section 311. The cap "requires the EPA Administrator to establish a specific quantity of emissions allowances starting in 2012". The amount of total American Emissions allowances is to be reduced every 10 years, the goal being for the United States to be at 17% of its 2005 emission levels by 2050. The administrator would have control over the yearly levels. Waxman-Markey Bill uses a hybrid approach to determining what entities are covered. Coverage of businesses are phased in over a 5 year period starting with the largest group potentially in 2012, including, all electric power generators, natural gas liquid, petroleum and coal based liquid fuel whose products when combusted emit over 25,000 tons annually, producers and importers of fluorinated gases except HFCs and Geologic storage sites. The second phase brings in industrial sources that produce 25,000 tons or more, not including emissions from petroleum and biomass. Energy

intensive industry, regardless of emissions quantity will also be included. The final stage brings in local natural gas distribution. Basically by 2016 84.5 percent of carbon emissions will be covered under the bill and be in the process of reduction.

The trade function of Section 311 focuses on how a reporting entity can allocate its carbon credits. Currently an entity can use their credits for pollution; bank saved credits for the future; or trades them to other entities that are over their allotted cap. The advantages of the Waxman Markey bill are a reduction of emissions by about 83%. Problems with the credit allotment include confusion over fair allocation and the whether or not the government should give away or sell credits. In some scenarios corporations may enjoy the benefits of bulk purchase or free allocation and crowd out smaller companies.

Two major problems with the Waxman-Markey Bill stem from credit allocation to large industries. Waxman-Markey will likely favor carbon credit allocation to industries that were in the room during policy making debate because their money and influence has bought them the ears of policy makers. This free allocation gives an advantage to already established businesses, hurting smaller producers who may not have large amounts of capital to make move towards green alternatives. This is a regressive wealth transfer that does not allow the benefits of a cap and trade system to be shared equally. The other problem is that Waxman-Markey does not give a clear price signal. The trade approach is confusing and allows large companies that are able to bank their allocated credits to potentially move the market to fit their needs, essentially manipulating supply and demand. A different Act proposed in the Senate avoids these

two issues that arise in the Waxman-Markey Bill[19].

The Senate CLEAR Act, proposed by a bi-partisan group of senators Cantwell and Collins, uses a cap and refund approach to control GHG emissions; however, in this bill Carbon Shares are allocated through sale. The clear language of the bill is already and advantage. The shares set at proficient level for carbon emissions and brought down to acceptable level through time. The bill would begin on January 1, 2011 and at which time the President and Secretary of the Interior would be able to set a number of Carbon Shares permitted to be sold into the economy. The first sellers of carbon are required to buy Carbon Shares directly from the government. This is dramatically different from the Waxman-Markey bill. The allocation of credits to large businesses is a direct investment in that business and transfers the control of price onto a complicated free market. Forcing all producers of carbon dioxide and carbon equivalents to buy credits directly from the government, at a set price, eliminates advantages to corporation. Collusion between corporations could lead to business practices that undermine the system. For example, a situation could arise in which a corporation that is threatened to have a tax levied on them could buy credits from a friend at a lower than market price; this friend may oblige for a number of reasons say their products are compliments like automobile manufacturers and oil companies; what is successful for one will hopefully raise the profits of the other . This sale however is below market price and undermines the carbon reducing system in place.

There is a refund portion of Collins and Cantwell that has numerous positive externalities. The CLEAR bill proposes that American households, or individuals with

[19] Livermore, Michael. CLEAR & The Economy Institute for Policy Integrity Report

social security numbers, are allocated 75% of the funds generated by the sale of Carbon Shares with the other 25% being allocated towards green technology, investment and innovation. The refund would come in form of a dividend check. The check could potentially include tips about how to invest the money in a way that will save energy and reduce excess spending on American's energy needs. Many of the low hanging fruit of energy savings are simple investments that are not captured because of there is a lack of will to invest. These checks would spur small home investment in electrical savings. About 20% of U.S emissions come from households and the CLEAR Act attempts to reduce this percentage.

The government would be creating a brand new commodity. This commodity would need a market place in which exchanges would occur. The government would initially have control over the entire market. It could either sell the carbon credits or give them away to industries that would require the most credits and be most economically harmed by the new requirements. If the government chose to sell the credits it could create as much as $50 to $300 Billion[20] worth of revenue. Though businesses are required to purchase the credits they will end up passing most of the cost down to the consumer. Consumers absorb the cost of carbon by paying a higher price for consumer goods. Deciding how to spend this revenue would have different effects on every sector of the economy.

The method of distribution that would have the smallest net effect on the

[20] Elmendorf, Douglas. "The Distribution of Revenues from a Cap and Trade Program for CO2 Emissions" Testimony before the Committee on Finance United States Senate, Washington. 7 May, 2009

economy would be to use the revenue to cut existing taxes; corporate or income[21]. Cutting existing taxes affected the lowest income quintile the worst and benefits the higher brackets. Wealthy households spend lots of money on taxes and would therefore receive a large portion of the rebates. Lower income households spend a larger percentage of their income on consumption. Electricity, transportation and agriculture are consumption items that would have increased costs. Under this economically justified scenario lower household would still have to deal with the additional price burden without receiving as large of a share returned to them through tax relief.

Avoiding such a transfer of wealth will require the proper set of distribution techniques. Distributing rebate checks to households or all people with social security numbers is a good way to prevent an uneven transfer of wealth. The rebate scenario gives low income households a larger amount of money to spend on consumption items that have increased prices. This money also goes to the wealthy so it is a fair deal.

Another proposal for spending of new wealth is to increase spending on research and development techniques that will make it more economically efficient to reduce emissions. Increased R&D happens in two ways. A policy that places a price on GHG motivates investment in carbon technology; companies will not only be looking for energy sources that produce less GHG but they will also be looking for technology that reduces the amount of carbon released into the air by their means of production. Therefore research and development investment will defiantly occur with any price of carbon. The second reason that more funding will go to science is that many of the bills

[21] Livermore, Michael. CLEAR & The Economy Institute for Policy Integrity Report

and proposals allocate a portion of the revenue produced from the taxation or sale of credits towards R & D. This is a good long term investment because technology implemented sooner can have an effect for a long time.

Putting all of these tools together allows economists to build a baseline. A climate change model baseline should be constructed given no policy that change GHG emissions. An alternate projection should be made for each different scenario. An important example of an CBA is what the EPA did with the Waxman-Markey bill.

The EPA's analysis has a reference scenario and four Waxman-Markey scenarios. The first scenario used title III only, the cap and trade portion of the bill. The second scenario allowed for energy efficiency allowance allocation (EEAA). EEAA is gives tax break or credits to firms that prove to go above and beyond in the carbon savings department. Scenario three account for output-based rebates. The output-based rebate scenario allocates carbon credits to carbon intensive industries. The fourth and final scenario does not allow for international offsets. An international offset is purchasing carbon sinks internationally; carbon sinks are forests or other things that keep carbon from the air.

For building a base case the most important numbers in cost-benefit analysis of carbon industry are electrical statistics, population and economic activity.[22] GHG emissions generally trend close to these numbers they are the foundation of your model. Generally for global models World Bank and United Nation numbers are used and local governments are able to use local resources whether it is the census or tax statistics.

[22]Weyant, John. "Economic Models: How They Work & Why Their Results Differ" Climate Change Science Strategies & Solutions. Eileen Claussen. Leiden, Boston, Koln: Brill 195

CHAPTER 3

A Great but Imprecise Tool

"Cost-benefit analysis(CBA) is a technique used for policy evaluation in which all the favorable and unfavorable effects associated with a policy change are identified, quantified and whenever possible evaluated in dollar terms[23]". The concept is pretty simple, economists calculate monetarily the costs and benefits associated with any investment decision or policy option and then compare the two sides. The best solutions have the most benefits for the least cost. CBA is a great tool that can cut down on special interest politics and the influence of one sided ideology; It uses sound, evidence based analysis to examine decisions instead of listening to special interests[24]. However, cost-benefit analysis is still a human created tool and is therefore susceptible to human preferences. And while ideally all cost-benefit analysis would generate identical outcomes, understanding how this tool works is important to safeguard against human prejudices.

Climate change is the current and previous generations responsibly are they responsible for the costs. United States historical growth trend predict that future generations are going to be wealthier than the current generation[25]. Given that the future people prosperous than modern people it could be posited that they will be more capable of dealing with climate change. An accounting must occur. If the price of preventing climate change is a smaller percentage of GDP than the percentage of GDP that would have to be committed to adapting to climate change than action of modern people is required. If the cost of adaption in the future is less than the cost of abatement then it can be left to future generations to deal with. Cost-benefit analysis

[23]Nordhaus, Williams. Economic and Policy issues in Climate Change Washington: Resources for the Future 113
[24]Livermore, Michael. The Cost Benefit Compass Institute for Policy Integrity 6
[25]Nordhaus, Williams. Economic and Policy issues in Climate Change Washington: Resources for the Future 124

can be used to evaluate what is the proper coarse.

Projects and policies generally use tool like cost-benefit analysis to determine if there agenda's create a net positive value or a Pareto improvement. Pareto improvements occur when policys make more people better off to the point that the gainers are able to compensate the losers and still have profit for themselves. If a policy creates a Pareto improvement it is generally considered a successful policy. There are two approaches to CBA, the aggregate and the distributional approaches. The more common aggregate approach monetizes, everything while the distributional approach compares costs and benefits that are not monetize[26]. One way to monetize the costs and benefits for the aggregate is to use the social cost of carbon.

Monetizing the effects of climate change requires economists to create unique tools. The social cost of carbon (SCC) is the new tool they use. "The SCC assigns a net present value to the marginal impact of one additional ton of carbon dioxide equivalent released at a specific point of time.[27]" The SCC has a high level of uncertainty and variation because it can be calculated many different ways; The IPCC review of literature shows a range of SCC from less than $1 to more than $1500. Their developed number is "US$43per ton of carbon with a standard deviation of US$83.[28]" Depending on what number you use your analysis will come up with entirely different results. The wide range of non-monetary units that the SCC can calculate, including the effects of agricultural productivity, human health, property damages and changes in ecosystem services, make it different from previous tools. Generally the SCC is

[26]Robert Stavins Economic Analysis of Global Climate Change Policy: A Primer Climate Change Science, Strategies and Solutions pg 184
[27]Scott Holiday and Jason Schwartz The Other Side of the Coin Institute for Policy Integrity pg17
[28]Yohe, Gary. Perspectives on Climate Change and Sustainability

calculated based on global net damages enacted from one additional ton of carbon; this calculation is supported by the interagency review[29].

An important distinction about this number is that it is from **global** damages of one additional ton of carbon. The Clear Act would likely use a price calculation that is similar to the SCC for its carbon credit sales. Under a new American policy like this when one ton of carbon is produced in America it would be subject to a tax that is based on a global SCC; American producers would end up paying a tax to the American government that is meant to support global welfare. Note here that the word tax does not mean tax but it means that the producer would be forced to pay to government for a pollution credit. It is however difficult to ignore a global SCC. To use an American cost of carbon number is to assume that Americans would be unwilling to pay for international damages caused by the U.S emissions into climate change and that Americans would not care about the extra international security risk produced.[30] This is a transfer of wealth from Americans into a global environmental fund that will primarily benefit the global poor in the future. Using a global SCC would be an example of a policy that contributed to an inter-generational and intra-geographical transfer of wealth.

The controversially of wealth transfers is however not unique to this issue. All tax policies or policies that affect the American economy are politically charged because they change the way that money moves through the system. Typically, climate change policy will have two types of wealth transfers. They will either be inter-generational, intra-geographical or possible both as exampled above. The question now becomes is

[29]Holiday, Scott and Schwartz, Jason The Other Side of the Coin Institute for Policy Integrity 33
[30]Holiday, Scott and Schwartz, Jason The Other Side of the Coin Institute for Policy Integrity 18

it America's responsibility to transfer wealth to future generations and those that need for survival on a changing planet.

The effect of policy on the free market manifests themselves as transfers of wealth. In the case of long term broadly encompassing environmental policy is an issue of transferring of wealth inter generationally and intra-geographical lines. The economic growth of the world is becoming more constrained by pollution and the availability of resources. Some of the world's resources are renewable and some are not but even the renewable resources have a limited reproduction rate. Humans now have the capability to determine how they are going to use every resource. This generation has such high consumption rates that have led to large overfishing to the point where "of the 894 federally managed fish stocks, 76 are classified as overfished and 60 are experiencing overfishing[31]."People today will likely make decisions about the allocations of the remaining resources for themselves and future generations. NOAA had great success removing fish from the overfished list in 2003[32]. There is always going to be a trade-off when deciding whether resources should be allocated to the living poor or saved for future people that could potentially be better off[33].

"Poor countries today are going to bear sacrifices in term of foregone benefits in order to benefit their richer descendants[34]" claim James Pierce and Oxford Economist. His argument claims that there is enough carbon in the atmosphere already for most of

[31]NOAA: Fisheries Report to Congress on the Status of U.S Fish Stocks <http://www.noaanews.noaa.gov/stories2004/s2243.htm>
[32]NOAA: Fisheries Report to Congress on the Status of U.S Fish Stocks <http://www.noaanews.noaa.gov/stories2004/s2243.htm>
[33]Stavins, Robert "Economic Analysis of Global Climate Change Policy: A Primer" Climate Change Science, Strategies and Solutions 186
[34]Peirce, David. The Social Cost of Carbon and It's Policy Implications Oxford Review of Environmental Policy, Vol 19, NO. 362

these damages to begin to occur. Money is poorly spent when it is invested in something will not see benefits for a long time. He would see money spent on preventing damages in areas that are most sensitive to climate change. Eliminating the damages costs from climate change brings down the SCC. Investment in bolstering the defense of countries in peril will have a potentially better effect than putting aside money to mitigate change if sensitive countries are also able to switch to low carbon prosperity. Opinions like this are very common among economists because they believe that money put aside for the future will have less value than if it were spent today. This valuation principle is called discounting.

Discounting is a technique used by economist to put a current price on future values. Money that is banked away for future use has less value than money today. For example, if money is discounted at 5% a year then if a $100 investment could yield a $105 dollar return this year and every year then if I delay that investment for a year my initial investment would only be calculated as a $95 investment and my returns from the next year would be $99.75. This discount rate is a descriptive approach rate. Here the discount rate is set equal to the return rate that could be achieved from capital.

There are two approaches to discounting, the descriptive approach and the prescriptive approach. The descriptive approach uses observable current returns to capital to set a corresponding discount rate (as example above); this is similar to the opportunity cost of not investing money). The descriptive approach is preferred because the prescriptive approach makes assumptions about the wealth of future

generations[35]. The financial crisis has opened many parts of America to the idea that constant growth is not always the case and that in the limited globe there may not always be room for 3% growth every year for fifty more years into the future.

The prescriptive approach discounts are based on the growth rate of GDP. This calculation is used because the economy grows a seemingly consistent rate and a set amount of money today has less value in the future. Michael Livermore of the Integrity Policy Institute believes that cost-benefit analysis should not discount at all. The reason for discount is merely people desire for money in the present and an excuse not to save. Money allocated for future generations can provide the same or more benefits to them as it could to somebody in modern day. Therefore discounting the money is inappropriate[36]. On the case of climate change money invested could have quite lucrative returns, depending on how you calculate the costs and benefits. Discounting proves to be one of the largest issues on the cost-benefit stage because it has the largest effect on model outcomes. The reason the effect of discounting is so large is that money is discounted every year. Money set aside in 2010 is discounted in 2011 and in 2012[37]. The revenue that could be generated from the discount value also never appears in the formula meaning that it can dwarf results incredible. For these reasons discounting is a political issue.

In CBA uncertainty is certainly a scientific one. There is an incredible amount of uncertainty that arises from economic and climate models because there is simply not enough data or not enough scientific evidence to be conclusive about how everything

[35]Nordhaus, Williams. Economic and Policy issues in Climate Change Washington: Resources for the Future 60
[36]Cost-Benefit compass 23
[37]Holiday, Scott and Schwartz, Jason The Other Side of the Coin Institute for Policy Integrity pg 19

that is going to happen. There is a wide range of possible outcome that can occur in the forecasted climate change scenarios. Economic models have to incorporate possibilities that the results of climate change may not be as expected or may be worse than expected. Economists have come up with a solution for uncertainty. Sequential decision making gives a map and course for when decisions should be made. A good cost benefit model does not need to look 500 years into the distant future and attempt to predict what will happen. A good CBA will look into the next 10-50 years and have result that put decision-makers in the best possible position to use the constantly updating data to take the next step.

Many models use the costs and benefits of destroying and protecting the environment to calculate economic conclusions. Calculating the benefits of protecting the ecosystem and costs of losing it is difficult. Eco-systems can either provide functions or services[38]. Functions are the biophysical processes in an ecosystem that create the conditions for services. Services are the outputs of ecosystem functions that directly or indirectly benefit humans. The services provided by the eco-system are most important; they include flood protection, food, recreational experience and the aesthetics of the landscape and animal protection. In 1997 eco-system services were estimated to be $44 trillion 2008 dollars in global services all in renewable sources; about half of that coming from nutrient cycles[39]. If humans do not protect the functions of the eco-system the service value extracted from it will be lost. Some of these services do not have any solid market value like animal protection and recreational experiences.

[38] Victor Flatt Let Us Drink Our Fill: The History of Water and its Impact on Resource and Environmental Management Yale Journal of Law and the Humanities, Vol. 17, No. 3, March 2006
[39]Gore, Al Our Choices 335

Determining the value of non-market services requires a measure of willingness to pay (WTP)[40]. WTP measures occurs using two different techniques, the indirect measurement and direct questioning[41]. Indirect measurement is an observational tool that views how people make trade-off or display their preferences in the market. This can be explained by paying higher prices for higher quality food products or travel to specific destinations for their environmental prowess. Direct questioning is used for items that cannot be measured by people changes in valuation. This is particularity true with passive or non-use value goods. They require surveys of people's values because they cannot be measured monetarily. People have future value (desire for future use), bequest value (desire for heirs to use) or existence value (intrinsic value) and the only way to judge these values is to ask[42]. These surveys are given to people and it makes them choose between different options. This preference reading gives economists an idea of where people values lay.

Economists have come up with multiple techniques for valuation and addressing issues of uncertainty, additional uncertainties that emerge are due to scale and location. Defining changes at the scale of the world and economy simple has a large standard deviation for error. Also, Political instability and emerging market models make predicting what is going to happen in the third world especially problematic. There are multiple hills and issues to overcome when building complex prediction models.

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[40]Pearce, James. The Social Cost of Carbon and it's Policy Implications Oxford Review of Environmental Policy, Vol 19, NO. 3 pg 364
[41]Stavins, Robert "Economic Analysis of Global Climate Change Policy: A Primer" Climate Change Science, Strategies and Solutions 179
[42]Stavins, Robert "Economic Analysis of Global Climate Change Policy: A Primer" Climate Change Science, Strategies and Solutions 179

Other assumptions that projection must make are the availability of energy resource and the possibility of technology substitutes. The largest emitters of GHG are fossil fuels; to project where GHG are going a view of the total amount of fossil fuels and their predicted price will provide a rate at which they will be emitted into the environment. A third controversial variable is technological change. Technological change is characterized by lulls and bounds. Predicting that bounds will come more frequently can be related to investment but using a constant technological growth rate is naive.

Building a sound economic model runs into many dilemmas. The social cost of carbon has made accounting much easier but it still can only be used if it is properly outlined how it has been calculated. A well reported CBA should always be used in cost-benefit models because it can have the largest individual effect on your benefits results. The results must be interpreted and calculated in ranges due to uncertainty. Measurement issues lead results that require interpretation. Models however do exist that can run evaluate and run functions accounting for the different inputs. Many models appear to be inefficient because participation is not expected from other countries. When global participation is factored into the cost benefit analysis than even better results occur.

CHAPTER 4

The Difficulty of International Treaty

Internationally addressing the global climate change issue has unique issues of its own but also must address standard issues of global agreements. The climate change debate is contentious because international carbon policies are going to affect economic. Every country wants to increase its wealth while participating in a global agreement. Climate change policies have to have certain rules and principles that outline the rules of the game. Shaping a set of rules that everybody can agree to has difficulties politically and economically. Some of those political reasons are founded in sound economics and this chapter will explore the realities and disillusions of these economic arguments.

The best framework that the world had going into the carbon talks was the Montreal Protocol. The Montreal Protocol addressed the issue of rising chlorofluorocarbons (CFC). CFCs had many of the same issues that GHG has. First of these issues was at the time there was uncertainty about whether CFCs would in fact deplete the ozone layer. The second similarity is that sine CFC were well mixed into the

stratosphere the effects of the release are independent of the location. Therefore a country cannot eliminate the effects of CFC on their own country by stopping their own release. Finally like carbon dioxide CFCs remain in the atmosphere for a long time and the effects of mitigation is not felt immediately. The protocol addressed CFC's successfully; both the European Union and the U.S reduced the amount of CFCs below the committed level in a faster than expected time frame.[43]

Two broach architectural ways to address environmental issues are the absolute value approach and the precautionary approach. The absolutist approach generally tries to stabilize emissions around a set target. The precautionary approach uses control criteria based on human health and the public good. Both approaches attempt to diffuse the level of GHG but the cost analysis of the two methods varies.

"The precautionary principle is meant to ensure that the public good is represented in all decisions made under scientific uncertainty. When there is substantial scientific uncertainty about the risks and benefits of a proposed activity, policy decisions should be made in a way that errs on the side of caution with respect to the environment and the health of the public.[44]" The approach has 4 guidelines for how policy should be formed; taking preventive action in the face of uncertainty; shifting the burden of proof to the proponents of an activity; exploring a wide range of alternatives to possibly harmful actions; and increasing public participation in decision making. The precautionary guidelines try to prevent the worst possible scenarios from occurring and therefore propose much stricter regulation on a wider variety of

[43] Hammit, James. Choosing Environmental Policy Washington: Resources for the Future Press 162
[44]David Kriebel, Joel Tickner, Paul Epstein, John Lemons, Richard Levins, Edward L. Loechler, Margaret Quinn, Ruthann Rudel, Ted Schettler, and Michael Stoto The Precautionary Principle in Environmental Science Environ Health Perspectives: (Online 15 August 2001) pg 6

pollutants.

The other more practical approach taken by economists is the absolute value approach; it suggests that there should be a GHG target level and each country should commit to doing their fair share to reach that level. This number generally floats from 200-500 ppm with 350 being the realistic solution. There is still significant debate over what the proper CO2 level of the atmosphere should be. The largest of these debates to date has been the Kyoto Protocol. "The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries and the European community for reducing greenhouse gas (GHG) emissions.[45]" These countries are called Annex 1 countries. The Annex 1 reductions commitments are an average of five per cent against 1990 levels over the five-year period 2008-2012." Some schemes that are being used to comply with the absolutist approach treaty have been carbon trading systems, clean development mechanisms (CDM's) and joint implementation. The European Union Carbon Trading System (EU ETC) is the first broad cap and trade policy. It is a hope that the American system could tap into this market and have a large effect on its effectiveness and scale. CDM's allow countries that are attempting to meet emissions reductions to establish and emissions reduction program abroad and account that value away from their countries net emissions. Finally, joint implementation programs which are similar to CDM's allow Annex 1 countries to set up projects that remove carbon[46].

To date the Kyoto Protocol has had almost no impact to reduce the absolute

[45] United Nations Framework Convention on Climate Change Website http://unfccc.int/kyoto_protocol/items/2830.php
[46] United Nations Framework Convention on Climate Change Website http://unfccc.int/kyoto_protocol/items/2830.php

amount of global emissions[47]. This is controversial statistic because most industrialized countries have moved towards their goals and even some select countries have achieved these goals. The reason that Kyoto has not effected global emissions is because of the schemes and loop holes set up in the Kyoto Protocol; when industrialized countries cut emissions they generally ship their high carbon industries abroad to non-annex countries[48]. Non-annex countries are mostly developing countries that are not able to address climate change as successfully. Many non-annex countries serve as great places for CDM's and joint implementation projects because they have cheaper land for joint implementation and more cost effective ways to achieve reductions for example solar panels; these are incredibly successful in Africa and other places with lots of sunlight.

Inside of the absolutist field there are two different ways in which calculation of emissions can occur. The current model uses a production approach. Each country attempt to control the amount of carbon dioxide they produce. Theoretically, economies would see similar results to what is being experience in the beginning of the 21st century. Countries would attempt to control emission by switching to cleaner electricity, avoiding production in high carbon industry and externalizing industry that creates lots of carbon. There are flaws in the production approach's architecture that is making the Kyoto Protocol so ineffective. Globalization is responsible for some of the issues. The Kyoto Protocol allows different countries to produce different amounts of emissions with some countries having to restrictions at all. This has allowed Annex 1

[47] Helm, Dieter. Hepburn, Cameron. The Economics and Politics of Climate Change New York: Oxford University Press, 2009 pg 19
[48] Helm, Dieter. Hepburn, Cameron. The Economics and Politics of Climate Change New York: Oxford University Press, 2009 pg 40

countries to reduce their emissions through the exportation of the carbon industry. Non-Annex countries do not have emissions reductions requirements and can absorb unlimited amount of carbon intensive industry.

The non-annex countries received this special treatment because of their historical output trends. They argued that since they did not pollute the environment over the past 200 years they should have the opportunity to develop as developed nations; therefore developing countries fall under the non-annex rules and are not yet bound to strict emissions reductions. There is already a significant amount of anthropogenic carbon dioxide in the air that they are not responsible for. China and India are two developing countries that have not yet made any binding commitments to cap emissions[49]. These developing countries are already very large polluters and are on a path to be the largest polluters in the next couple of decades. The other argument that developing countries make is that they should not be sanctioned for the output of their factories when they are shipping all of the carbon intensive goods abroad. The consumers should have to pay for the additional carbon they consume. This argument leads international policy makers to consider that an absolutist production approach may not be the best idea.

Some economists prefer the consumption approach because it is able to increase competitiveness of local markets, controls the excessive consumption of first world countries and can help developing countries catch up. It would however condemn industrialized countries to massive reductions in output and consumption. This tool that would be used would be a heavy carbon tax on all goods. A carbon tax

[49] Helm, Dieter. Hepburn, Cameron. The Economics and Politics of Climate Change New York: Oxford University Press, 2009 pg 33

would tax everybody in the world for using carbon. This would make it difficult for countries to ship their carbon emissions abroad because the tax would be returned to them when they bought the product. This would create responsible carbon usage behavior[50].

To date no global or American system has been put into place that has been able to receive significant results. The Copenhagen Accord became the next stage for international carbon talks and was fairly unsuccessful. Current failure of the United Nations Framework Convention on Climate Change (UNFCC) to achieve results fundamentally arises from the nature of modern political economies and the architecture of the treaty. Politically the resistance arises from local governments that are unable to come to a consensus on what they proper action because they do not want to participate in a system that they have no control over. Economically governments want to avoid putting themselves in a position that could endanger their economic standing; climate change treaties often constitute significant transfers of wealth

Politically however one reason that there has been so little international action is that governments are entering the 21st century with less political power. Pluralistic systems of government do not allow for quick movement on multi-dimensional problems in the absence of clear public mandate[51]. Ray Vernon and Roger Porter outline this inefficiency of government interactions issues very well. They make the point that when foreign economic issues arise that require the coordination of multiple

[50] Helm, Dieter. Hepburn, Cameron. The Economics and Politics of Climate Change New York: Oxford University Press, 2009 pg 20
[51]Lee, Henry. "U.S Climate Policy: Factors and Constraints" Climate Change Science Strategies & Solutions. Eileen Claussen. Leiden, Boston, Koln: Brill 119

government agencies like the CBO, EPA or EIA the process becomes inefficient. They describe it as friction and explain that historically the United States have done a poor job coordinating these agencies. The three branches of government were created to prevent against tyrannical takeover or radical motion. This organization makes legislating incredibly inefficient especially in the face of strong political objection.[52] Agreements must be reached between agencies, branches and committees are all difficult when so many opinions exist. This does not advocate some type of climate czar but it does suggest that it could lead to real climate action.

It is not necessarily all the governments fault. Governments are elected as the representatives of the people. They need a clear mandate from the people to enact a policy that is controversial. As long as there is doubt about climate change prospects and what will happen to the economy very little action will be taken. Different outcries include a lack of oversight, damages to the economy and the free-rider issue.

The largest issue preventing countries like America and Australia to sign into the (UNFCC) programs is the free-rider issue is tied with enacting legislation or any type of climate change regulation. The dilemma is that if one country reduces emissions all other countries can benefit from those reductions. If America was to begin to combat GHG emissions then there is a reduced incentive for other countries to act accordingly. Unless some type of economic restraint is put onto Brazil, China, India and other large polluters they will have the ability to benefit from reduced emissions from the EU and America while emerging markets continue to pollute in increased amounts. There are ways to combat the free rider issue so that firms in countries that reduce emissions are

[52]Lee, Henry. "U.S Climate Policy: Factors and Constraints" Climate Change Science Strategies & Solutions. Eileen Claussen. Leiden, Boston, Koln: Brill 119

able to maintain competitive. Countries that enact carbon legislation would belong to a group and know who the fellow countries that have carbon taxes. Governments could then set carbon tariffs on goods imported from countries that manufacture without carbon taxes. That way all countries not participating in an at home GHG or carbon system will have a tax levied on their exports. This will also motivate more international commitment to a treaty.

One of the reason there is so much doubt in the system is because there is no international enforcement agencies. The ability of a country to renege on the agreement or misreport on their emissions is always a fear. The world has a history of mediocre compliance with environmental treaties that have low cost obligation so a treaty with high costs is likely to have spotty participation[53]. Even if there was some type of over sighting body it would be unrealistic to think that almost any sovereign country would submit them to that type of control. If countries or politicians wanted to deregulate for the purpose of the economy they would have that option.

The damages to the economy are especially important. Many politicians are more interested in getting re-elected than what is doing what is best for the country in the long run. Economics is the most important issue to voters. The science of climate change shows that many of the benefits are not going to be realized until the future while the cost would be suffered today. Because politics has fairly fast turnover rate and limited terms some politicians are apprehensive about enacting a policy that could hurt the economy in the short run and therefore hurt their possibility for re-

[53] Nordhaus, Williams. Economic and Policy issues in Climate Change Washington: Resources for the Future 146

election[54]. The constituency has a point; the best example of a country that looks to be a loser from climate change treaties is the United States. There are people that believe that because a climate treaty is not beneficial to Americans then they should not be obligated to participate; even though America is responsible for the second largest emissions in the world.

Some political economists even go as far to argue that third world countries should be paying countries that stand to benefit from global warming to cut emissions. Mendelsohn & Neumann took on the task of evaluating the impacts of climate change on the United States. This study takes and aggregate approach to CBA and does not take into account non-market factors. Therefore this evaluation will not cover human quality of life. The covered industries are farming, timber, coastal, energy and water. The report was written in 1999 making it slightly outdated but still a valuable resource to convey what credited economists believe are the coming impacts of climate change on the United States. The test was conducted under nine different scenarios with results vary from -0.1% of GNP to .03% of GNP in 2060. The scenarios vary three different temperature increases with three different precipitation scenarios.

The Mendelsohn & Neumann report suggest that American agriculture will not be adversely affected and that it may even get a little bump from climate change[55]. Currently it is within the range of predictions that there will be increased growing season in many of the Northern latitudes as well as increased rainfall[56]. Some physical advantages that America could have from climate change issues like increased

[54] Nordhaus, Williams. Economic and Policy issues in Climate Change Washington: Resources for the Future pg 141
[55]Impact of Climate Change 55
[56]Adams, Richard. "Impacts on the U.S Agricultural Sector." Climate Change Science Strategies & Solutions. Eileen Claussen. Leiden, Boston, Koln: Brill 38

temperature and CO2 would be less frost killings in southern citrus farms and larger farm yields that occur because of air with higher CO2 levels. Some negative effects associate with climate change are increased heavy rains that cause erosion, flooding and wash away top soil.

The general rule of thumb when evaluating agricultural damages and effect are that high latitude regions will benefit and low latitude regions will be hurt. There has been decreased rainfall between 10°S and 30°N since 1980[57]. This latitude range holds large population of poor and already mal-nourished people; climate change is going to put greater stress on places like Mexico and Africa.

Similar with agriculture there should be an increase in U.S timber production. Increase CO2 availability and more water mean more production and better profits for American timber[58]. The timber market is however very dependent on global forces so if there is a larger % increase in global timber than in American timber American timber producers could be hurt.

Sea level rise is one way in which Americans are hurt worst, but still mildly compared to global estimates. The two ways actors that contribute to sea levels rise are an increased volume from ice melting and thermal expansion of the oceans. The current rate of sea level rise is about 1-2.5 mm a year. At this rate by 2100 a 50 cm rise in sea level could be seen and $20 Billion- $150 Billion[59] worth of damages could result. The cost of sea level rise would come from; displacement of wetlands and lowlands, coastal erosion, increased vulnerability to coastal storm damage, flooding, salinization

[57]http://www.climate.org/topics/water.html
[58]Mendelsohn The Impact of Climate Change on the United States Economy 128
[59]Neumann, James "Sea Level Rise and its Effect on Coastal Resources" Climate Change Science Strategies & Solutions. Eileen Claussen. Leiden, Boston, Koln: Brill 44

of surface water and groundwater. The three ways that human have planned to escape these threats (outside of sea-level rise prevention) include; prevention which are physical projects to prevent damages, planned retreat including restriction on coastal development and post-disaster recovery plans that are located away from the coastline.

Another economic sector that is only a 3$ billion dollar market but holds incredible political sway is the fishing industry[60]. Global climate change will affect the surface temperature of the sea, upwelling, salinity, stratification and circulation patterns. The size of the oceans and unknown effects that new the environments will have on fish exemplify all of the problems with complex CBA. Results from U.S Fisheries show that the benefits from to U.S fisheries could be anywhere between 2 and 10 percent of U.S fisheries and the damages could be between 3-10 percent[61]. Whether the fishing industry ends up netting in the positives or negatives is unknown.

Politics is overwhelmingly dominated by economics. Creating an environmental treaty that bolsters the economies of the largest polluters is going to be impossible. Industrialized countries want to ignore that the growth of the past 150 years has been built on pollution. Coming to grips with the idea that consumption and production create waste that has externalities and long term negative benefits is not easy. For government officials cannot tell their people that they will have a different standard of living is impossible because nobody wants to hear that message and government officials are elected to give the people what they want to hear. Currently, some of the largest polluters have not committed to reductions and that is unlikely to change. If

[60]Neumann, James. The Impact of Climate Change on the United States Economy 237
[61]Neumann, James The Impact of Climate Change on the United States Economy 237

they continue to refuse to commit a coalition should be built to stand against them. The coalition could consist of countries that will have the worst effects of climate change and countries that accept that pollution cannot be unregulated. The most effective way to combat climate change would be for this coalition of countries that stand together and enact a carbon tax.

Appendix: Internship Write-Up

The Institute for Policy Integrity is a group funded by the New York University Law

School for the purpose of non-partisan advocacy for solid government decision making. I was an intern in the communications department and assisted Scott Holiday on economic projects. The institute published two important papers while I was interning, one a commentary on the National Flood Insurance Program (NFIP) the other CLEAR & The Economy. The position mostly focused on communication work. Daily tasks were with Patrick Kiker. Communications covers a broad range of topics from research and organization to submissions and editing. All of the experiences were educating and taught valuable lessons.

One of the papers published during the spring of 2010 was about the National Flood Insurance Program. It was a commentary about how the NFIP benefitted certain states disproportionally, encouraged development in unsustainable areas, cost the tax payer money and contributes to the destruction of the natural world. It reports that that the NFIP leads to great economic disparity between rich and poor and gives discounted insurance rates in areas that would have high social value if the land was not subsidized for home owners by the federal government.

The Institute for Policy Integrity also reported on the CLEAR Act and the way that the bill affects innovation, job creation and showed the costs and benefits associated with bill. The results were that CLEAR encourage innovation by making renewable energy more competitive. CLEAR enacts a small carbon tax to raise the price of electrical generation using coal. This price increase makes wind energy economically feasible.

The report also concludes that many renters and landlords suffer from an inability to take action because issues including lack of salience, cognitive dissonance and

normative bias. The CLEAR Act can help address these issues by issuing rebate checks. These checks would serve to reminding Americans about what good decisions they could be making and help encourage smart investment.

In the jobs section it concludes that there will be increased employment for the sector of Americans that are most out of work like manufacturing and construction. CLEAR creates green jobs. The cost-benefit conclusion is most important. "CLEAR avoid regressive wealth transfers and is neutral in terms of regional differences." It is at least cost saving or neutral depending on the SCC especially considering the low implementation costs compared with other environmental policies.

Other projects not yet published included the evaluation of the Copenhagen Accord. One issue that came up during the treaty was how countries from the third world that do not have as much access to capital to invest against the issues of global warming can cope with climate change. Some countries appear to become wealthier because of increased growing seasons, more access to resources, and health improvements. Other places however will undergo immense harms. Rising sea levels will cause flooding, deserts will get worse and the tropics will be unlivable because extensive heat and illness. Scott Holiday and I looked directly at the sea level issue. Scott and Michael were building their own model to evaluate how countries would fare. Their model compared susceptibility to damages and the costs.

The model designers wanted to compare their model to the wealth of global knowledge that is available. Acquiring data for comparison from third a party is an issue all over the academic world. Scott received data in to form of a map color

coded to show approximately the difference that climate change would make in different areas. It was the job of the intern to match up each color coded country to its name. This becomes incredibly difficult once you start to look at all 273 nations. The second task was organizing the data into groups that had different claims to the UNFCC about what their likely damages were. After the data was compared the conclusion was drawn that the model was incredibly accurate for large countries and not as accurate for smaller countries, economically speaking. A little preview to their next paper, they are going to reconcile these differences by having some sort of value measure to countries importance at the international conference table. Doing research and working with people that truly wanted to understand and help others understand the issues in the field of environmental economics was defiantly the most enjoyable part of the work.

The communications department, where my internship was primarily focused, concentrates on raising awareness for the institute. The goal of the communication department was to get into as many good press sources as possible. The first step of a good communications program is to identify who in the press is writing about your issues. This means reading a broad variety of news sources every day and pulling the articles that are pertinent to your interests out and organizing them. Some of the issues that interns pull for the institute for policy integrity are cost-benefit analysis, green economics, cap and trade, cap and dividend, regulatory review and at least 20 other topics. This is done by going through an e-mail account that has certain sources linked to it and scanning those sources as well as doing basic Google searches for the topics. Once the news sources have been organized they are ready for review. Every article must be read and the contact information of every important person in a business,

NGO, academic institution or governmental organization must be pulled. It is then determined who of these people is important and who is not. The important persons are then contacted for various things like opinions, interviews or general networking. The authors of these articles are also kept for contact when new reports or studies are released. After all the names have been pulled and organized comes the research portion of the job. Each contact must have their e-mail, phone number and address located and put into a Microsoft Excel document. The Excel document is accessible to every member of the institute and holds many of their personal contacts. Communications is an integral part of the Institute for Policy Integrity's work and the intern is useful in making the department efficient and useful.

Other educational jobs that the intern must perform include assistance in general busy work. Some of the more enjoyable busy work I did for the fellows and law professor were editing, submitting and running around. The task of submitting papers is incredibly daunting. Law papers must be reviewed by their peers and then published. Often an author will not know which law journals are the best for the particular subject being submitted so research about what journals specialize in what must be done prior to the authors being ready to submit. The author may also choose to submit an essay to anywhere from 1-30 different journals for review. Editing tasks are not the editing of law papers; editing is either of random inter-office releases or schedules. Schedules varied depending on whether the office was hosting a conference or they had a special batch of students coming to visit and needed schedules for their time at the school. Finally, when the institute got especially notable press it would be the responsibility of the communications department to get copies of the literature for memorabilia or trophy purposes. When it came to leg work I was frequently asked to

retrieve press things.

Working with the Institute for Policy Integrity brought together a variety of different skills. Working with economists, lawyers and communications people that all have unique concerns about the environment and find different ways to cope or understand the issue. It defiantly broadened my horizon on the emerging field of environmental politics, economics and law. The work also did a great job of keeping me informed about what was happening in the press and expanded the press sources that I use for my own reading. My excel skills obviously improved. I worked 3 days a week. Tuesdays I was able to clips from home this generally took 1-3 hours and had to be completed by 10:30 A.M. Wednesdays and Fridays I went into the office generally between the hours of 11-5. They were pretty flexible about my schedule and I often had to make adjustments based on my own personal schedule and this was not a problem. Completing this internship was one of the most time consuming tasks I have done but was highly rewarding.