Exploring the Effectiveness of Climate Change Deals through Behavioral Game Theory

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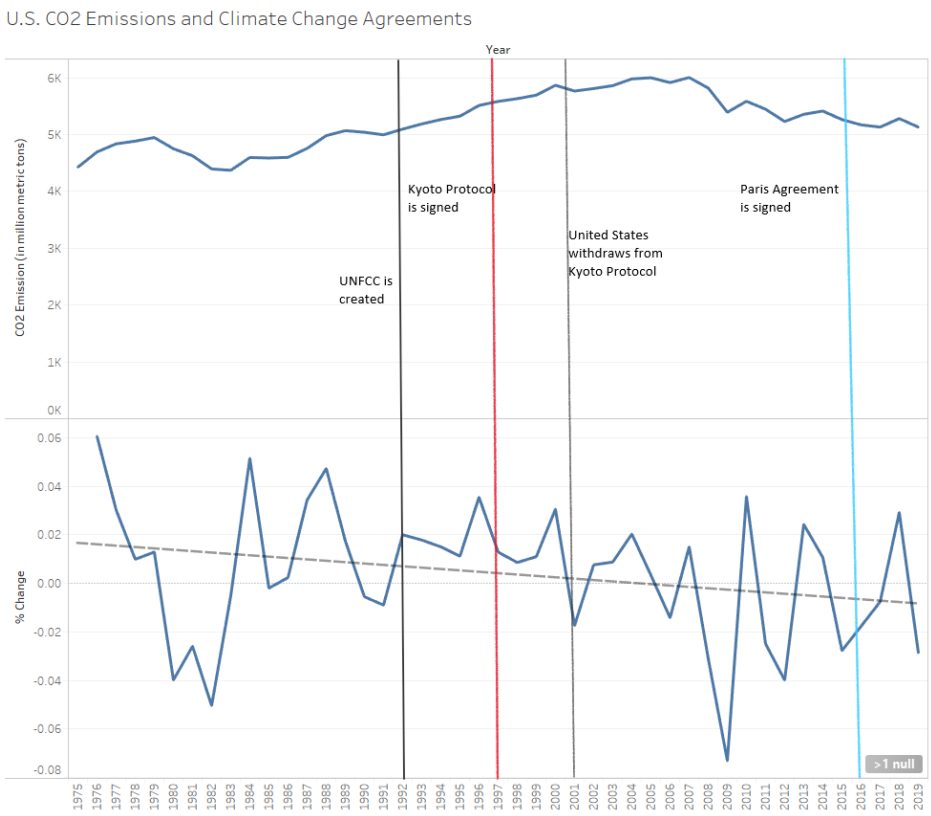
Overview

Environmental economics differs from other disciplines of economics in that the classical framework of policymaking does not apply as easily. Policies regarding the regulation of firms to limit carbon dioxide emissions are highly politicized, making it more difficult to pass the bill through the lawmaking process. For example, traditional economic theory suggests that it is perfectly rational to impose a carbon tax to limit CO2 emissions. A federal carbon tax has yet to be implemented in the United States because oil is an extremely vital natural resource that fuels our economy, and more expensive energy damages the country's economic output and competitiveness. Developed nations are responsible for most of the CO2 emission from their more active industries, with per capita emissions typically as much as ten times the average in developing countries (Grubb 2012). Without an organization like the United Nations to push developed countries into taking preventative actions, it would be more difficult for a nation to justify weakening their power on the global stage (Chanis 2104).

The most significant international treaty created to combat climate change was the Kyoto Protocol, which set forth concrete guidelines that built upon the United Nations Framework Convention on Climate Change (UNFCC) in 1992. The UNFCC is a non-legally binding agreement that set no mandatory limits on greenhouse gas emissions and was signed by 154 countries. International conferences have been successively held almost every year since the UNFCC was entered into force, with the goal of establishing more concrete guidelines to the initial framework. Although the Compliance Committee of the U.N. created an Enforcement Branch, this branch has no real power over non-compliant parties



The data on U.S. emissions show that since the initial UNFCC in 1992, the year over year change in CO2 emissions has been on a downward trend but did not start decreasing for consecutive years until the year 2009. The United States withdrew from the Kyoto Protocol in 2001, calling the treaty unfair because it targeted developed nations heavily and would have hurt the economy. The U.S. also placed particular emphasis on the time lag associated with the implementation of policies and estimated that results would be realized approximately by the year 2010 (Grubb 2012). Despite pulling out of the Kyoto Protocol in 2001, emissions continued to reduce year over year,

The Kyoto Protocol seemed to be successful in reducing global emissions, but the reasons are not so clear, according to classical economics. Classical economics alone cannot explain why the developed nations participated so well in a protocol that was poorly enforced, and why the U.S. decreased its CO2 emissions without international pressure. Although the Compliance

Committee of the U.N. created an Enforcement Branch, this branch has no real power over non-compliant parties (MacCracken, Edmonds, Kim, & Sands 2012). Therefore, self-interested countries should theoretically have no incentive to stop depleting natural resources like oil, resulting in higher CO2 emissions. This is not what the data support, and this anomaly is an example of why behavioral economics is a more useful lens to view strategic decision making in climate change agreements.

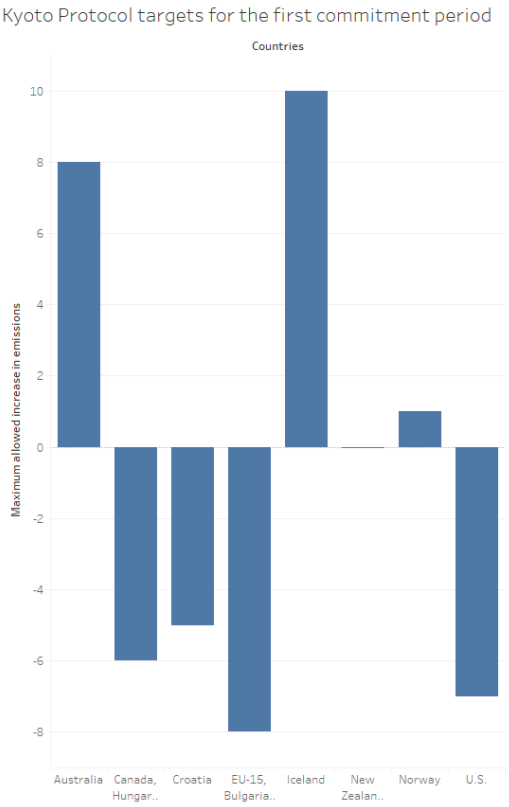
Behavioral Game Theory

Behavioral economics studies situations where agent do not make decisions based on bounded rationality, which assumes that agents are rational and make optimal decisions given all necessary information (Camerer 1997). In the context of climate change agreements, all countries have the same information; greenhouse gas emissions need to be curbed, and the U.N. is providing a framework to facilitate achieving this goal. Despite this, there were still many years of negotiation in the rules of the Kyoto Protocol. The study of these strategic interactions, involving conflict and cooperation, and be studied through behavioral game theory.

Behavioral game theory is a subset of behavioral economics which studies the choices that lead to weakened rationality assumptions (Samuelson 2016). Scenarios studied in game theory typically involve two or more self-interested parties that attempt to find the ideal equilibrium. The conclusions of game theories do not guarantee a particular outcome, but mathematically show ideal choices and attempts to rationalize why a certain party would make their choice, whether it is rational or irrational.

Ultimatum Bargaining Game

In the context of climate change deals, bargaining games provide an explanation of how nations act in negotiating greenhouse gas restrictions. In an ultimatum bargaining game, there are two self-interested individuals bargaining for something of value, and one of them makes a take-it-or-leave-it offer. Ultimatum games are especially useful for measuring how people feel about the allocation of money between themselves and others. This is the most simplified version of a bargaining game, and although there are no ultimatums given at U.N. climate change meetings, the results can be used to explain why the U.S. chose to withdraw from the Kyoto Protocol and still experience a decrease in greenhouse gas emissions.



The emissions target for each country was determined by several factors, such as population and industry output, so developed nations were burdened with lower emissions targets (Bodansky 2016). Countries with very low emissions, like Australia and Iceland, were actually allowed an 8 and 10 percent increase in emissions. The EU-15 is comprised of fifteen of

the major European countries, including the U.K. and France, who agreed on reducing emissions by eight percent distributed between all 15 countries, under a "burden-sharing" agreement. In contrast, the U.S. emissions target was set to decease emissions by seven percent, which is a substantially higher target than one from an individual country in the EU. Assuming the burden is shared equally in the EU-15, each country would only be expected to decrease emission by approximately .53%. The U.S. was expected to decrease emissions by 6.47% more than an individual European country. Although this makes sense since any individual European country is substantially smaller than the U.S., it could still lead to the perception of unfairness from the U.S.

The studies from the bargaining game show that individuals are sensitive to the perception of fairness and equality, and less about the actual amount of what is being bargained over, in this case, the emissions target (Camerer 2003). This is referred to as negative reciprocity and can lead individuals to incur a substantial cost if there seems to be unfair behavior. The U.S. possibly recognized the unfair burden that it incurred and avoided negative reciprocity by backing out of the Kyoto Protocol in 2001. Bulgaria and several other Eastern European countries did not avoid negative reciprocity, and was burdened by the lowest emissions target, compared to the rest of Europe. This was not a substantial amount of emissions to decrease since their economics are relatively small, so the -8% target seemed reasonable, but is unfair in a bargaining game.

One compelling explanation for a party's willingness to incur more cost is the concept that some cultures operate under different standards of fairness (Camerer 2003). There is the possibility that the countries with the -8% target felt that it was reasonable considering the negative externalities associated with greenhouse gas emissions, whereas the more

individualistic, self-interested culture of the U.S. recognized the unfairness of the Kyoto Protocol, and acted according to the game theory and withdrew from the agreement. Another theory explains the country could have rejected the more rational decisions due to the desire to reciprocate fairly, with the goal of pleasing the U.N. and maintaining its status in global efforts to fight climate change. A more successful way to structure the Kyoto Protocol to appeal to larger countries, according to game theory bargaining, would be to offer more equal emissions to developed nations that are comparable in size and influence, which would have possibly prevented the U.S. from rejecting the agreement.

Conclusion

The ultimatum bargaining game can attempt to explain the strategic decision-making behind international climate change agreements and raises questions about the effectiveness of these deals. The U.S. negotiation tactic was in line with game theory, which eventually led it to withdraw from the Kyoto Protocol due to unfairness. On the other hand, some European countries accepted the larger -8% emissions target, acting contrary to how behavioral game theory would predict. The bargaining game offers insight into why a party might accept an agreement that incurs substantial cost to itself compared to others but falls short in explaining the decrease of U.S emissions with no international pressure from the United Nations. Assuming the burden is shared equally in the EU-15, each country would only be expected to decrease emission by approximately .53%. The U.S. was expected to decrease emissions by 6.47% more than an individual European country

There have been many bills passed to combat climate change since the U.S. withdrew from the Kyoto Protocol, which could explain the decrease of emissions starting in the year

20089. Climate change has become a highly politicized issue in recent decades, which may explain why the U.S. is so successful in passing climate change legislation related to this issue. While there is little evidence of the effectiveness the Kyoto Protocol itself in the U.S., the publicity of the agreement possibly sparked interest from the general public, who in turn determine the agenda of elected officials. In this regard, climate change agreements are indirectly impactful.

The most recent climate change agreement, the Paris Agreement, is a non-binding commitment to pursue efforts to reduce greenhouse gas emissions. The U.S. signed the agreement in 2016 at its creation, but formally withdrew in 2020. It was a highly controversial decision, but evidence from the Kyoto Protocol shows that the Paris Agreement has little effect over the U.S. emissions output, especially since the Paris Agreement is not legally binding, whereas the Kyoto Protocol was. Game theory suggests that smaller countries have the incentive to project strength and activism more than a superpower like the U.S., so signing the Paris Agreement provides more value to them. In the future, emphasis should be placed on passing legislation within nations to combat climate change, and less on international climate change agreements, which have already served their purpose in drawing global attention to climate change, but provide little actual value to the issue today.

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