Strategic Behavior and Determining the Direction of United States Climate Policy

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ABSTRACT

The US has long been faced with competing influences, making it challenging to determine which direction(s) to go regarding climate change policy. This not only impacts the US, but also the environment of the entire world, the international community of nations, and American diplomatic relations with other countries whose environmental policy, philosophy, and practice may differ from that of the US. Adopting policy regarding climate change requires navigating the complicated political and social quagmire of today, and thus policy logically must seek to align incentives between actors with competing decision strategies as much as possible. This study considers United States climate policy from the framework of economic parallel rationality as a mechanism for understanding strategic interaction in making climate change-related choices. A mathematical probabilistic framework is proposed to express the strategic interaction between two actors aimed at individual joint choice of climate change decisions. The mathematical framework takes into account the presence of mistrust and its impact on outcomes of strategic interaction regarding climate change policy. Policy recommendations are then made that suggest that environmental policy over the next decade, particularly related to climate change, cannot afford to be a simple command-and-control system, though it does need centralised organisation for efficiency and effectiveness. Instead it must involve representation from buy-in by as wide a group of stakeholders possible in a way that increases trust to maximise likelihood of an optimal outcome. A partial approach to policy is unlikely to be successful.

Keywords: Climate change, Strategic Interaction, Decision Strategy, Environmental Policy

1. Introduction

The US has long been faced with competing influences, making it challenging to determine which direction(s) to go regarding environmental policy, and especially most recently, short-run and long-run measures concerning climate change. This not only impacts the US, but also the environment of the entire world, the international community of nations, and American diplomatic relations with other countries whose environmental policy, philosophy, and practice may differ from that of the US. Furthermore, the US is faced with a great array of internal opinions, coupled with recent extreme politicization of environmental issues, especially climate change, creating an environment in which a variety of decision strategies compete strategically with each other (Gaard, 2014). The US needs to adopt policy regarding climate change measures over the next decade, which will necessarily require navigating the complicated political and social quagmire of today. In order to do so, policy logically must seek to align incentives between actors with competing decision strategies as much as possible, or at least attempt to balance them as much as possible (Johnson, 2018). Even with the challenging political and social landscape, such policy must nevertheless focus on long-run effectiveness rather than short-term benefit, political gain, or reactions to emotional soundbites. That is, it must be considered a multishot game rather than a single shot game. This paper considers what such a policy should look like for the United States within the framework of strategic interaction.

2. Climate Change Initiatives

One of the most important issues, and arguably the first that must be decided, is who should take the lead on climate change initiatives. There is an unfortunate mistrust of the federal government within many segments of the population, and efforts to deal with environmental issues at the federal level today have become incredibly politicized such that it is reasonable to question how effective a federally-led initiative would really be (Wooster, 2018). Such a mistrust suggests an interesting strategic dynamic, i.e., that one set of actors believes that the other set of actors in the climate change decision transaction are untrustworthy, thereby lowering the probability of an alignment of incentives and a satisfactory outcome. Put another way, this mistrust adds a term into any form of game, transaction, or strategic interaction equation that can act against behaviour leading to an optimal outcome. Trust becomes essential to the alignment of incentives and the achievement of an optimal outcome.

The principle of subsidiarity suggests that decisions should be taken at the lowest reasonable level. It is questionable that states and cities, however, are really the best level at which to make strategic decisions regarding climate change. The reason is that strategic decision behaviour tends to make individuals and small groups lean towards decisions that benefit themselves, even if there are externalities imposed on other parties (Miller, 1999). Local authorities also often take great offence at what they perceive to be federal interference. Should that point of view persist, then federal efforts to obtain state and local cooperation for federal strategic climate change initiatives would likely be stymied. Nevertheless, nationwide cooperation is necessary for climate change initiatives to be successful (Tompkins and Adger, 2004). Federally-led regulations have also been shown to be positively impactful (Williamson, 2016). Yet strategic interaction between different levels of government within the United States, unless resolved, are likely to continue hampering the process.

Additionally, since climate change initiatives carried out by one country or several countries may have little or no overall positive impact without buy-in and cooperation from a large number of countries, there is also a need for international oversight and cooperation. What one country does in terms of environmental output or production easily impacts at least some other countries since the environment is connected and does not stop at national borders. This necessity for cooperation also leads to suspicion and distrust on the part of many citizens and indeed even some in the federal and especially local governments of what is perceived to be for interference. Somewhat surprisingly, this negative view extends to the United Nations, even though the United States is a signatory to the United Nations (Call, Crow, and Ron, 2017). These facts further complicate the landscape that the EPA and other federal agencies must navigate, for ultimately American efforts in climate change will likely be pointless without coordinated international effort. Thus probabilistic outcomes of strategic interaction within the United States necessarily have an additional component of strategic interaction regarding environmental issues with other countries. That includes a term for a trust factor that has the potential to reduce the probability for an efficient and optimal outcome.

An expression, following Johnson (2016, 2017), for strategic interaction between various actors in a climate change policy setting can be given as Eqn. 1 below:

$$(1)\ \psi_A = \begin{cases} Prob^*(x_A|x_B)\ at\ the\ decision\ point; \\ Prob(x_A)\ s.t. Prob(x_B)\ otherwise. \end{cases}$$

Eqn. 1 gives the probability function in the parallel rationality framework using mathematical Choice Waves, derived from quantum mechanics, for two actors, A and B, which could be the public and government, or any two other actors. Each chooses a climate change policy bundle, *x*. There is a continuous probability that A will choose a particular bundle subject to the bundle choice of B. At the decision point, following the economic parallel rationality principles, this will collapse to a specific choice by B, and then the specific choice by A given the choice made by B. The actor B, then, has an exactly symmetrical version of this equation.

So far this only accounts for basic differences in decision strategy. It is entirely possible that incentives are so far out of alignment that outcomes based on the choice of A given the choice of B will be suboptimal anyway. However, if the assumption is made that Eqn. 1 will lead to efficient, optimal outcomes, i.e., both actors ultimately seek the same positive results, then it provides a starting point to add in the problematic term of mistrust. This is represented in Eqn. 2 below:

$$(2)\ \psi_A = \begin{cases} Prob^*(x_A|x_B, M_{AB})\ at\ the\ decision\ point; \\ Prob(x_A)\ s.t. Prob(x_B)\ and\ M_{AB}\ otherwise. \end{cases}$$

In Eqn. 2, the choice by A of the climate change decision bundle, *x*, is conditional now not only on the associated choice by B, but also on a mistrust factor, M_{AB}. The mistrust factor could be a simple binary factor indicating the presence of mistrust. Yet it appears that mistrust is simply a given factor, and therefore the magnitude of mistrust is more useful. Thus *M* is taken here to be a magnitude term such that a greater degree of mistrust is more likely to lead to a suboptimal outcome. However, the presence of mistrust, though generally expected to be present, may or may not result in a suboptimal outcome if the magnitude of the term *M* is insufficient.

Therefore, a probability of mistrust at every feasible level of magnitude should be considered. This is included in Eqn. 3 below:

$$(3)\ \psi_A = \begin{cases} Prob^*(x_A|x_B, M_{AB}^*)\ at\ the\ decision\ point; \\ Prob(x_A)\ s.t. Prob(x_B)\ and\ \psi(M_{AB})\ otherwise. \end{cases}$$

In Eqn. 3, at any given point during the potential interaction between actors A and B, the decision of mistrust is expressed as a Choice Wave probability function over all possible levels of mistrust by A of B. At the decision point, the Choice Wave collapses as usual to probability of 1 at the revealed mistrust level of M_{AB}^*. Following Johnson (2016), the expectation value of mistrust can be expressed as $\langle M_{AB}\rangle = \int_i^j \psi(M_{AB})dM$ as usual. Although the actor A is most likely to choose a level of mistrust at its expectation value, other things being equal, this mathematical framework permits other choices of mistrust to be chosen without violating A's underlying utility maximising strategy. Thus the outcome of a strategic interaction between A and B regarding the choice of bundle of climate change decisions is dependent not only on the mutual impact of one actor on the other, leading to a classic Nash equilibrium, but is dependent on the probabilistic presence and magnitude of mistrust by A of B. Again, though, the presence of mistrust only is assumed to be impactful if it is beyond a certain critical level that would cause a deviation from the optimal outcome. This then is given in Eqn. 4 below:

$$(4)\ \psi_A = \begin{cases} Prob^*\left(x_A|x_B, \begin{matrix} if\ M_{AB}^* \geq M_{crit},\ then\ M_{AB}^*; \\ else\ 0. \end{matrix}\right)\ at\ the\ decision\ point; \\ Prob(x_A)\ s.t. Prob(x_B)\ and\ \psi(M_{AB})\ otherwise. \end{cases}$$

Eqn. 4 provide a satisfactory expression, then, of the probabilistic Choice Wave of A. There is a probability that the level of mistrust at a given decision point in a transaction between A and B will be above the critical level, M_{crit}, in which case a suboptimal outcome becomes possible or likely. If that level has not been reached, then the regular assumed optimal Nash equilibrium should result. Whichever the case, the expectation value of climate change decisions by A is simply given by the integral over Eqn. 4 across all possible choices of x_A as usual.

Mathematically the functional forms for B are simply symmetrical with those of A. However, in the case where A is assumed to be the general public, and B is assumed to be the government, the power differential tends to render distrust of the public by the government less of a factor, making faith in government and institutions far more important. Therefore, when considering possible policy on the part of government (in this study, the United States government), it must bear in mind the probability function of mistrust. This implies a necessity to choose policies that will minimize mistrust, keeping them below the critical level in Eqn. 4. Failure to take into account mistrust will, according to Eqn. 4, very likely perpetuate continued suboptimal outcomes in climate change policy.

The probability of mistrust can be modified by actions taken by the other party. This is given in Eqn. 5 below:

$$(5)\ \psi_A = \begin{cases} Prob^*\left(x_A|x_B, \begin{matrix} if\ M_{AB}^* \geq M_{crit},\ then\ M_{AB}^*; \\ else\ 0. \end{matrix}\right)\ at\ the\ decision\ point; \\ Prob(x_A)\ s.t. Prob(x_B)\ and\ \psi(M_{AB}|Z)\ otherwise. \end{cases}$$

In Eqn. 5, the probability function of mistrust is not conditional upon the level of *Z*, a bridging mechanism following Johnson and Walker (2018). That bridging mechanism is simply an action taken by B in order to build trust with A. So, in terms of strategic interaction, the choice of *x* by A is dependent upon the choice of *x* by B, as well as the level of *M,* which is in turn influenced by B through the choice of *Z.* Knowing this, B can influence outcome by its own choices, and especially by taking into account *Z.*

3. Mechanisms for Dealing with Climate Change

In considering policy, the specific mechanisms of dealing with climate change issues must be considered. There are some, such as Senator Edmund Muskie, who believe that air pollution, held to be a leading cause of climate change, should not be analyzed economically or that anyone should be given the right to pollute for a fee. However, complete eradication of pollution is not practicable and is unlikely to receive the necessary widespread support (Phaneuf, 2005). Indeed, the more a policy is viewed as impracticable, the more likely the mistrust term in Eqn. 4 is likely to exceed its critical level.

Abatement is a much more rational approach that is able to be done at an appropriate speed and thus is more likely to find common ground among the nations of the world. Since many of the objections to pollution control are economic, ongoing economic analysis is necessary in order to demonstrate that effective environmental protection measures can be carried out in ways that do not harm long-run economic growth (Polasky et al., 2019).

One approach proposed by both those who want total pollution removal and those in favour of abatement is pollution caps through direct regulation. In that approach, the government regulating authority imposes a maximum amount of pollutant emissions/discharge that a company may generate in a given timeframe. Although that has the definite potential to reduce emissions, it has nevertheless several problems. First of all, since pollution abatement typically imposes costs on the firm, at least in the short run, a firm has no real incentive to reduce emissions beyond that which is required by the regulation. Firms also differ in cost structure and technology availability. Since that necessarily implies a likely difference in the marginal abatement cost between firms, for the same expenditure, a firm with a lower marginal abatement cost could achieve a larger reduction in pollution. Yet, with a regulatory cap in place, such a firm would have no incentive to do so. The more likely outcome is that they still reduce only to the level that they are required to do by regulation, and due to their lower marginal abatement cost, they would maintain a cost advantage over their competitors. Pollution cap regulations, then, typically only go only so far in achieving the goal of reducing pollution as much as possible. Economic pressures get in the way.

A similar approach is pollution taxation. In that approach, firms are charged a fixed rate per unit of output of pollutants. Firms have, therefore, an economic incentive to reduce pollution output as much as possible. Yet, the problem of different cost structures between firms remains a problem. Firms with low cost ability to engage in pollution abatement could do so with relatively little impact from the pollution tax, while firms facing a higher cost structure would be saddled with much higher financial burden. That has the potential to change even the very structure of the market, as some firms may exit the market if they find the cost to high. On a positive note, this does have the potential to foster technological innovation that reduces pollution output and thereby reduces total production costs.

Another solution that can get around those economic pressures and align the financial incentives of the firm with the pollution abatement goals of the regulatory agency is the use of tradable permits. That approach recognises the differing cost structures between firms, as well as the different needs to produce production-related pollution emissions, which may vary between time periods. If every firm were to start with the same number of permits, for example, then those with lower marginal abatement costs and/or less of a need for pollution output in a given time period could sell those to other firms facing higher marginal abatement costs or which have a greater need for pollution output in that specific time period. In that way, economic forces could allow for the specific amount of permissible pollution defined by regulation to be allocated according to where it is most "needed." That is, those who have a higher willingness to pay for pollution output in a given time period would be those who bear most of the cost. And, similar to direct taxation, tradable permits give an incentive for technological innovation that further reduces pollution. Put another way, this approach within the framework of strategic interaction between companies and government, can help to align incentives and be more likely to achieve an optimal Nash equilibrium.

4. Policy Recommendations

Based on the challenging landscape facing environmental protection efforts, as well as the need to limit the public-government mistrust factor to avoid suboptimal outcomes in the framework of strategic interaction, it is recommended that the EPA adopt the following policies.

1. Direct regulations placing a cap on pollution be abandoned in favor of tradable permits. This permits market forces to cooperate with environmental protection efforts rather than hinder them and further promotes technological innovation in favor of environmental benefit. Over time, then, as technology improves, the abatement level and rate can be increased in a manner that can be easily borne by the firms. This helps to align incentives to increase likelihood of an optimal outcome.
2. Regulation ultimately must be managed at the federal level, with significant input from a wide array of NGOs and due cooperation with international agencies and nations. It is clear that independent efforts are unlikely to be successful. Also, there is a significant potential for local efforts, even if well-meaning and scientifically sound, to be nonetheless at cross purposes with each other, canceling each other out, reducing possible benefit, or making matters worse. Such efforts and cooperation by NGOs are proposed as a mechanism for reducing the level of the mistrust factor, M, and keeping it below its critical level.
3. Since the achievement of items one and two above require cooperation and buy-in from local and state authorities, it is necessary to ensure that impact on individuals and localities is minimized. Also, a public affairs and internal diplomacy effort of a significant level is needed in order to help bridge the gap between local and federal decision strategies. That public affairs campaign is necessary in order to promote the alignment incentives between individuals, local areas, states, the national level, ultimately the world. A potential way to accomplish this alignment is through appeals

to self-interest rather than altruism since self-interest has been a leading impediment to environmental policy cooperation (de Dominicis, Schultz, and Bonaiuto, 2017). This step should likewise help to reduce the level of the mistrust factor, M, and keeping it below its critical level.

4. Mechanisms must be put in place to support vulnerable communities that are victims of climate-related disasters. Communities must be assessed proactively in advance to determine vulnerability (Ford and Smit, 2004). Considering vulnerability and potential impact can help to build trust.
5. Policy implementation must remain flexible in order to modify as needed to support overall strategy.

5. Discussion

This study considered United States climate policy from the framework of economic parallel rationality as a mechanism for understanding strategic interaction in making climate change-related choices. A mathematical probabilistic framework was proposed to express the strategic interaction between two actors aimed at individual joint choice of climate change decisions. Within that framework, the presence of mistrust was incorporated as a probabilistic term such that there exists a probability that a level of mistrust will exist above a certain critical level that would shift the outcome out of its optimal Nash equilibrium. That probability can be modified by actions taken by the other party. For example, the probability of excessive mistrust by the public of the government can be modified by actions taken by the government. It can also be modified by the efforts of organizations such as NGOs collaborating with government. The presence of such actions by both government and auxiliary support can then help increase the likelihood of an optimal outcome of climate change-related choice.

These policy recommendations are aimed at learning from past mistakes and moving forward with a focus on effectiveness and benefits for all stakeholders. The biggest problem currently facing success of US and global environmental policy, and indeed the most significant hurdle moving forward is the current misalignment of incentives between different stakeholders. That is fueled largely by mistrust between stakeholders. That will be the biggest challenge of the EPA and other regulatory agencies, as well as cooperating NGOs. A decision to move forward with this recommended policy must absolutely be made simultaneously with a devout resolution to expend significant resources in helping those incentives to align as widely as possible. If the policy is adopted without such determination, it will most likely fail due to the countless pressures imposed upon it. Appealing to different self-interest motives of different stakeholder groups may be a useful tactic. Environmental policy over the next decade, particularly related to climate change, cannot afford to be a simple command-and-control system (though it does need centralized organization for efficiency and effectiveness), but must involve representation from buy-in by as wide a group of stakeholders possible (Tompkins and Adger, 2004). Put another way, this cannot be successful if it is a mere project done halfheartedly. It must either be done completely or not at all. Analysis suggests that the world cannot afford the latter.

REFERENCES

Call, C.T., Crow, D., and Ron, J. (Oct. 3, 2017). Is the UN a friend or foe? *Brookings.* Retrieved from: https://www.brookings.edu/blog/order-from-chaos/2017/10/03/is-the-un-a-friend-or-foe/

De Dominicis, S., Schultz, P. W., & Bonaiuto, M. (2017). Protecting the Environment for Self-interested Reasons: Altruism Is Not the Only Pathway to Sustainability. *Frontiers in psychology, 8,*(1065). doi:10.3389/fpsyg.2017.01065

Ford, J.D. and Smit, B. (2004). A Framework for Assessing the Vulnerability of Communities in the Canadian Arctic to Risks Associated with Climate Change. *Arctic, 57*(4).

Gaard, G. (2014). What's the story? Competing narratives of climate change and climate justice. *Forum for World Literature Studies, 6*(2).

Johnson, R. (2016). A Probabilistic Demand Application in the American Cracker Market. *International Journal of Food and Agricultural Economics, 4*(3).

Johnson, R. (2017). Choice Waves and Strategic Interaction. *Journal of Technology Research, 7.*

Johnson, R. and Walker II, E. (2018). A Probabilistic Shortage of Private Land Opened to Hunters in Northwest Minnesota. *Modern Economy, 9*(1).

Miller, D.T. (1999). The Norm of Self Interest. *American Psychologist, 54*(12).

Phaneuf, D. (Jul. 13, 2005). Cost Benefit Analysis. *Environmental Economics: The Cromulent Economics Blog*. Retrieved from: https://www.env-econ.net/2005/07/costbenefit_ana.html

Polasky, S., Kling, C. L., Levin, S. A., Carpenter, S. R., Daily, G. C., Ehrlich, P. R., Heal, G. M., and Lubchenco, J. Role of economics in analyzing the environment and sustainable development. *Proceedings of the National Academy of Sciences, 116*(12). DOI: 10.1073/pnas.1901616116

Tompkins, E. L. and Adger, W. N. (2004). Does Adaptive Management of Natural Resources Enhance Resilience to Climate Change? *Ecology and Society*, 9(2).

Williamson, B.C. (Nov. 24, 2016). Do Environmental Regulations Really Work? *The Regulatory Review.* Retrieved from: https://www.theregreview.org/2016/11/24/williamson-do-environmental-regulations-really-work/

Wooster, M. M. (Jan. 25, 2018). Politicizing the environment is hurting its cause. *Philanthropy Daily.* Retrieved from: https://www.philanthropydaily.com/politicizing-the-environment-is-hurting-its-cause/