Computing, Information Systems, Development Informatics & Allied Research
ISBN 978-2257-44-7(Print) ISSN 2167-1710 (online)
Vol.3 No.1 March 2012

Global Strategies for Stable Climate: An Assessment Approach

Felix Iyalomhe
PhD Candidate of Science and Management of Climate Change.
Faculty of Economic.
Cä Foscari University: Venice, Italy
955702@stud.unive.it

ABSTRACT
Climate change described by climatologists and environmental economists as a trans-boundary problem is a great challenge confronting human existence. To this end, achieving a stable climate requires some kind of international environmental agreement that takes into account each country's emission (i.e., cooperation). Given such an agreement, is it necessary to supplement with some kind of policy coordination? The present paper tried to investigate why cooperation could be supported with coordination, even though it is possible to achieve the best outcome (i.e., emission target) when countries have an international environmental agreement with emission charges focus on each country's emissions (i.e. cooperation alone). In this context, the paper also outlines possible elements that could facilitate cooperation among countries in order to establish an effective coalition, considering previous global treaty (e.g. Montreal Protocol; Kyoto Protocol).

Keywords: Cooperation, coordination, stable climate, public goods and environmental agreement.

1. INTRODUCTION

Climate change is recognized as the most urgent and critical problem confronting the global community. Temperature increases and rainfall will likely hamper agriculture and stress global ecosystems. Sea level rise and severe storm-surge may likely erode and inundate coastal regions, indeed; the major threat is the obvious evidence of abrupt shift in the climate or variability in climate if we keep increasing greenhouse gases in the atmosphere. This has been confirmed by the recent reports from scientific communities and stakeholders, in particular, the fourth assessment report (AR41IP a g e) of the intergovernmental panel on climate change IPCC, (2007) stated that global warming is unequivocal, and human actions are changing the climate with major impacts on ecosystems, development and human well being. The world has been warmed by an average temperature of 0.7°C since pre-industrial era and following business as usual scenario, global temperature will increase further 1.8ºC to 4°C by the end of 21st century Murphy et al., (2009). Accordingly, change in temperature in this direction might result to dangerous climate change that would have severe impacts on human development in the future. This calls for stabilization of greenhouse gases (GHG) in order to prevent what United Nations Framework Convention on Climate Change (UNFCCC) called "dangerous anthropogenic interference with the climate system" UNFCCC, (1992).

This will make global ecosystems adapt easily to present climate, agricultural food production not hamper and sustainable economic development guaranteed. Recent scientific studies to assess potential impacts of climate change and policies to address it used modeling tools that can simulate complex entities (e.g., atmosphere; land; ocean etc); projected results that are embedded in uncertainty because of the dynamic and non-linear interactions existing between these entities. In other words, models' results can only support the process of solution generation and not provide exact solution. In the light of this there is rising concern for action; the challenge of designing an effective policy to mitigate climate change- increasing the global average temperature that is relative to total greenhouse gases in the atmosphere contributed by countries in the world. Accordingly, a global concerted effort is require to limit or reduce the effect of this change in temperature on the global climate Laurent and Viguier, (2004), as a public goods that is enjoy in common by all countries, and each country's consumption does not affect another country's consumption Samuelson, (1954).

Perhaps, this indicates why is very expedient and necessary to have effective strategies that can serve as platform for solving the climate change problem so that there would be stability in the climate system, which can guarantee environmental sustainability needed for global economic development and the overall human well-being. In this context, the paper adopts an assessment approach to consider strategies such as cooperation and coordination among host of others that can be employ at the global level of climate change negotiations, with possible involvement of many countries from different continents of the world, taking into account the complexity of their regional differences (e.g. economies, technology, political institutions etc). Emission control policy as one of the proposed strategy to tackle climate change at the global level Tol, (2003), demand cooperation among parties or countries under the agreement, couple with coordination of the implementation process or indigenous policies linked to the global strategy in order to achieve optimal outcome or effective mitigation system.

2. STABLE CLIMATE A GLOBAL PUBLIC GOODS

Laurent and Viguier, (2004) described public goods as those goods available to all at the same time, irrespective of location. They also considered the global climate as pure public goods because it possess the properties of non-rivality and non-excludability, this implies that changing a market price would not be effective as free-riding cannot be prevented and consumption by one person does not affect others' consumption while Kaul et al., (1999) claimed that the global climate is indeed a general global public goods because it is available to countries, people and also generations, including future generations.

We can clearly state that climate change mitigation is a global public goods since benefits of this action are not limited to those involve in the process, Laurent and Viguier, (2004) coined it as 'climate stability' pure global public goods because benefits from (GHG) emission reduction are non- rival, non-excludable and are present to all countries and people. However, the efficiency of a particular country mitigation effort ultimately depends on others choice of action, for instance even if European Union

increases their emission reduction commitment from 20% to 30%, without corresponding efforts from China; US; emerging economies and the developing countries there will be no meaning results.
This would rather encourage leakage effect; that is emission producing firms relocate their plants to countries that are not committed to emission reduction (i.e., free-riders) and also due to differentiated demand in energy between abating countries and free-riders' countries. A typical example is leakage effect associated with the Kyoto protocol implementation that may likely be increase from 5% to 30% by 2010 Babiker et al., (2002); Viguier, (2001).

Indeed, public goods are pure when they are not only non-rival and non-excludable but non- contingent. In other words, climate change mitigation is contingent global public goods because the usefulness of a particular country's mitigation efforts depends on others' efforts and the size of the agreement Laurent and Viguier, (2004).
This is why the paper considers international cooperation and coordination of policies among countries as strategies that can ensure effective mitigation action, since most of these gases are long-lived in the atmosphere and that emission contribution from every country irrespective of the amount spread worldwide to ignite the global problem. Accordingly, controlling or solving this problem may be costly and few countries alone cannot do much unless there is a global cooperation efforts coordinated by a standard regulation process that take into account each countries' indigenous policies.

3. ASSESSMENT OF STRATEGIES FOR STABLE CLIMATE: COOPERATION

Despite the fact that climate change impacts on the earth are unambiguous and mostly debated at national and international level due to the transboundary nature (i.e. permeate the borders of countries over the earth) combine with the increasing scientific consensus, the path towards international agreement is still very much slow because reaching an ambitious agreement among heterogeneous parties or countries that want to maximize their benefits at the same time minimizes costs would be very difficult, if not possible Favero and De Cian, (2010).

Moreover, climate change is considered a global negative externality that can lead to irreversible damage (Stern, 2006) and as such requires urgent and collective actions (Favero and De Cian, 2010), which means cooperation and coordination of climate policies are needed to achieve results. In theory, it has been observed that global markets provide an optimal welfare or utility maximization (i.e. allocation of resources based on scarcity signal by prices but in practices prices cannot actually signal scarcity correctly, particularly environmental goods and services such as climate change or stable climate Buchner, (2010).

This basically refers to what economist called market failure; a problem due to lack of property right on global goods or common like stable climate. Consequently, there is tendency for countries to free-ride (i.e. refusal to act because the benefits of others action will not be stricted to them alone). Nevertheless, to achieve an effective mitigation system there must be an international agreement base on voluntary basis; where countries will negotiates how to cooperate on global problems like climate change. The economic rationale for cooperation teaches us that efficiency can be reached only if all the parties involved in resource allocation are part of the externality, in other words sharing cost and also benefits Samuelson, (1954).
In the cooperative game theory proposed by John Von Neumann and Oskar Morgenstern, (1944), they introduced a game theory model called the strategic situation theory; where they tried to model the possible interaction of multiplayer using two basic approaches, the cooperative and non-cooperative game. Accordingly, Marchi et al., (2007) claimed non-cooperative game theory involve players that may be countries coming to an agreement on voluntary basis, only if it is self-enforcing (i.e. provide incentive for players to participate in the agreement) while the cooperative game theory considered countries as a group of possible players. The basic idea is that, each player makes decisions to maximize their utilities and these decisions affect each other's utilities instead, cooperative game tried to determine possible outcomes of the agreement, possible achievement of each player, the kind of agreement that could occur and how the outcome will be distributed whether robust or stable.

Therefore, the cooperative game theory result to either a full cooperation among players or free-riding incentive, which could lead to tragedy of common that is often seen in environmental goods like stable climate. In the real application, there are agreements on how to manage global public goods; how are these formed? Barrett, (1997) claimed that "international negotiation success depend partly on the acumen of the negotiators and the nature of the problem addressed". Perhaps, the absence of an intermediate cooperation limit the cooperative approach of achieving agreement (e.g. the prisoner's dilemma game does not foresee the repeated interactions among countries, possibility of learning from past actions and commitment that could enhance initial cooperation), which describes the non- cooperation game theory.

Non-cooperative game theory model analyzes the interactions or negotiations between countries and incentives that can allow the formation of intermediate cooperation, this basically evolve in two steps: formation of coalitions (i.e. countries decide whether to participate in the agreement or not, after which they determine the optimal policy to adopt (i.e. what will be CAP or emission reduction target for players). Since the atmosphere is managed as global common good, no institution with regulating power to impose property right, hence it is imperative to design a negotiating mechanism that can lead to self-enforcing agreement Carraro, (1997). Moreso, the non-cooperative game theory provides the opportunity for countries to achieve this kind of agreement and the two possible outcomes are partial and full cooperation. While partial cooperation is rational and could be a possible outcome, taking into account the existence of intermediate cooperation between these countries Carraro and Siniscalco, (1993).

This is quite different from the cooperative game theory in the sense that, in non-cooperative game theory there are three basic steps: i) the entire negotiation process is study and countries' incentive are characterized. ii) There is formation of intermediate cooperation and this will lead to determination of the optimal policy- emission reduction target. Indeed, taken the theory of cartel formation into consideration, partial cooperation could be the outcome of non-cooperative game D' Aspremont et al., (1983), where profitability and stability (internal and external) constitute the core of the agreement but the differences in (technology, human capacity, economic institutions etc) across countries and the incentives to free-ride makes it not possible to achieve full cooperation Carraro and Siniscalso, (1993). Contrarily, self-enforcing international environmental agreement can still exist may be with limited number of countries that would take into account other possible incentives mechanism (e.g. transfers and linkage

issues etc) during the negotiation process Barret, (1994). While it is also possible to have grand coalition outcome, i.e. when all the countries agreed to participate but this cannot lead to equilibrium coalition because when the number of countries participating is high, there would be a very small different between cooperative and non-cooperative coalition and the complexity of sovereignty principle will be higher.

As remarked in the previous paragraphs, achieving an ambitious self-enforcing international environmental agreement among countries, taking into account both the economic rationale and the game theory model, we see the possible achievement of partial cooperation from the non-cooperative coalition seem almost impossible because of the incentives for countries to free-ride and also the presence of asymmetries across countries Carraro and Siniscalco, (1993). Perhaps, the differences in technology and economies of these countries and human capacity etc; will make it not profitable for countries in Africa, Asia, South America etc (developing countries) to afford the costs of mitigation technology and policies, at the same time develop their economies. In view of this, there may not be alternative option to free-ride, knowing that profits from emission reduction achieved by other countries are non-excludable and ultimately lead to a cooperation that is not stable Carraro, (1997). Conversely, the issue of linkage may help to reduce if not avoid this unstable cooperation, if international trade is link to climate change policy negotiation and possible sanctions apply to check non-compliance. As a matter of fact this was used in the Montreal Protocol to enhance compliance.

4. THE NECESSITY OF COORDINATING CLIMATE CHANGE MITIGATION POLICY?

In consideration of general policies rationale, there is a high degree of interdependence among countries because of bilateral and multilateral interactions that make each country's welfare somehow dependent on its own action and action of any other country via trade, human capacity building, technology transfer, financial aids etc.

This may affect the effectiveness of both unilateral and multilateral policies of countries and ultimately the total welfare of these countries. In this context, there is need for policy coordination at both national and transnational level. Consideration of transboundary environmental problems like climate change, where our main objective is to achieve emission target, it may be necessary to support our policies with some sort of standard regulations (as coordination). But in the opinion of Hoel, (1997) and (1991) this is not too correct because if there is an international environmental agreement with special attention on emission level of each country, perhaps, with the application of emission trading scheme we can still achieve emission target. Though it is also possible for countries to act selfishly and this can result to higher emission Hoel, (1991).

In the present paper, the author tried to answer this fundamental question: should we coordinate mitigation policy or leave environmental policy to each country to decide? Hoel, (1997) emission target with transnational environmental problems demand some sort of international agreement, if not there may be tendency for each country to maximize its own welfare while considering the environmental policies of others as given, whereby our non-cooperative game theory will ultimately produce higher emission. In other words each country only takes into account harm on its environment and not others' environment. Although it has been proved that it is possible to achieve emission target with international agreement (i.e. cooperation) Barret, (1994b); Hoel, (1997) only when all markets are competitive, otherwise if we have imperfect competition in markets and unemployment this will call for coordination of mitigation policy.

For transboundary problems (e.g. climate change) Hoel, (1991) has shown that though some environmental groups like NGOs have advocated in time past for unilateral actions to reduce harmful emissions because it may serves as a good example to change other countries' behavior, improve the chances of having an international agreement but the outcome will ultimately lead to higher emissions if countries acts selfishly. This was further strengthen by the same author but in a different paper; even if there is an international agreement that adopt the emission trading scheme, without coordination, we will only arrive at a second-best emission target Hoel, (1997). This is because none of the countries involved can influence the international price of emission permit that is also not exogenous.
This may encourage indirect subsidization of affected sectors and will discriminate between sectors and cause inefficiencies in the agreement, by possible increase in production and emission in these sectors Ploeg and De zeeuw, (1992). In theory, when the market is allowed to operate with its devices there will be high production and a corresponding high emission, but when individual countries apply emission charges unilaterally, this will reduce production and also emission and if this is coordinated, we may experience further higher charges for emission but lower production and emission Ploeg and De zeeuw, (1992). For instance, even if there is carbon tax on fuel consumption without a coordinating scheme (e.g. standard regulation like application of efficient technology in vehicles) we may not achieve the lowest level of emission target. In the opinion of the author, coordination of mitigation policy will not only help to reduce the lapses due to asymmetry of countries involve in the cooperative agreement but will facilitate the achievement of effective mitigation system that will lead to desire emission target.

4.1 Are there applicable lessons we can learn from other global treaty?

Within the context of environmental problems that are transboundary, several global international agreements have been adopted. In particular, the "Montreal protocol" To protect the earth ozone layer by reducing the global production of ozone depleting chemicals (CFCs, HCFCs, etc). The most interesting aspect of this protocol (agreement) is the worldwide acclaimed success achieved since the inception in 1987 to early part of the 21st century. One would ask, what are the reasons for this success? That can be consider in similar international cooperation; Barrett, (2001) and Oberthur, (2001) have tried to analyze the close linkage between the Montreal protocol and the global climate change treaty (e.g. Kyoto Protocol).

In their analysis; among the prominent element is the financial mechanism adopted in the Montreal protocol, which was enclose in the umbrella of "Common but Differentiated Responsibility" In the contemporary climate change negotiations, this implies: developed countries had to provide some kind of incentives for the developing countries because at the beginning the latter was just like an onlooker and not willing to participate in the Montreal treaty.
This was also called Side payment used to increase participation in a cooperative agreement involving great asymmetries of countries effectively committed to being non-signatories for example developing countries in the Montreal Protocol Barrett,

(2001). Another important element was the incorporation of scientific knowledge of the problem into the agreement and taken as incentive to develop new and alternative technologies. The precautionary principles cannot be left out, because waiting until all the relevant questions are answer may be too late and this can result to irreversible damage that even the best mitigation policy cannot reduce or prevent.

Flexibility of the protocol or agreement would create room for easier accommodation of current scientific solutions and their political and economic implications to the goal of the agreement. Also trade sanctions may not be too effective because of possible legal implication and the nature of the public good provided Barrett, (2001), but considering the Side payment given as incentives for cooperation, there will be justification if credible sanctions are impose on non-compliance. In other words, every signatory have incentives or oblige to participate in the agreement.

5. CONCLUSION

Climate change is a global problem that requires the agreement of countries on earth to solve and the provision of stable climate as global public goods depends on how these countries can cooperate and coordinate policies irrespective of the great asymmetries among them. Moreover, it is possible to achieve emission target in a non-cooperative coalition if all markets are perfectly competitive. If the case is otherwise, coordination is necessary in order not to achieve the second-best emission target. Taking this into account, we may need to consider previous successful global treaty (e.g. Montreal Protocol) for approaches that can promote effective cooperation and coordination of policies towards agreement that would be stable and achieve the desire emission target.

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Author's Brief

Felix Iyalomhe is on the PhD programme in the Science and Management of Climate Change at the Doctoral School in Global Change Science and Policy, Department of Economics, Ca' Foscari University Venice, Italy.

He holds a Bachelor's Degree in Computer Science from the University of Nigeria, Nssuka and a Master's Degree in Energy Technology from the University of Gavle, Sweden. He is affiliated by his doctoral research to the Euro-Mediterranean Centre on Climate Change, an interdisciplinary research consortium in Italy (www.cmcc.it) and the Climate Change Risk Assessment and Management unit- University of Venice, Italy, and also a Visiting PhD Student at the National Environmental Research Institute (NERI) Dept. of Policy Analysis University of Aarhus, Denmark. His research interest is on the analysis of regional climate change impacts and risks on human environments and associated systems with specific focus on coastal systems. In this perspective, he also studies how climate science can be more useful to climate change adaptation policies through in depth analysis of the science- policy interface. He can be reached at felix.iyalomhe@stud.unive.it and by phone Tel: +393887980085

End Notes: This work first appeared in the Proceedings of the International Conference on ICT for Africa, 2011.