**THE ECONOMICS OF GLOBAL ENVIRONMENTAL CHANGE**

**Cooperation and competition in global environmental policies**

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# Transformation need

Climate change poses potentially catastrophic consequences for the world population, possibly affecting everything from the costs of producing food, energy, coast habitability and outdoor recreation. The risks of “business as usual” greenhouse gases’ (GHG) emissions trajectories are becoming more visible and higher, as the challenges that they impose on us. We are already crossing marks (like the 400 ppm of CO2 in the atmosphere on average in April 2014, according to measures at the NOAA’s Mauna Loa Observatory) and passing tipping points (like the one marking the unstoppable collapse of the marine ice sheet of the Thwaites Glacier basin of West Antartica (Joughin et al., 2014) that make the need for immediate and significant reductions in GHG emissions more evident (Hansen, 2010). In fact, decreasing emissions of GHG may not be enough. Given political feasibility constraints and the amount of CO2 already in the atmosphere, carbon sequestration and storage, and other forms of geoengineering such as solar radiation management, seem to be necessary (Barrett, 2013; Barrett et al. 2014).

Climate change therefore can be regarded as probably the major source of global environmental change and its consequences are strongly related to the concepts of sustainability and sustainable growth. Discussing sustainability issues in the context of climate change introduces the need to link climate change with comprehensive wealth, since wealth is a fundamental measure for examining whether economic growth is compatible with sustaining wellbeing over time (Arrow at al., 2012). Comprehensive wealth, whose maintenance over time is a fundamental condition for sustainability, consists not only of reproducible capital and human capital, but also of natural capital, health improvements, technological change and social capital. Climate change and global environmental change affects and is affected by the evolution of wealth and its structure in terms of the different components of capital. This means that from the point of view of climate change, it is clear that climate change has a major impact on sustainable growth, while from the point of view of sustainability, addressing the issue of climate change implies attainment of sustainable growth. Thus a meaningful study of the economics of global environmental change should study issues related to both climate change and sustainability and their interrelations.

In particular in terms of climate change issues such as mitigation, adaptation and geoengineering; risk and uncertainty and precaution; fairness among countries and generations; catastrophes, tipping points and regime shifts; cooperation and competition in the design of environmental policies; and spatial and sectoral effects and interactions, are on the frontier of current research efforts.

In terms of sustainability, major issues are the specification and appropriate estimation of indexes for wellbeing; shadow values for the different types of capital, that is reproducible, human, natural, health, and social capital; comprehensive investment. Furthermore, the incorporation of considerations related to uncertainty and geography into sustainability measurement are open research questions.

The purpose of the proposed research project is to study the economics of global environmental change in the context of climate change and sustainability. Our aim would be to link open research questions in the economics of climate change with sustainability, study the interactions and the feedbacks; explore the development and the design of appropriate policies; and apply our modeling framework to specific case studies.

In this context specific issues that we plan to study include:

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Both mitigation of emissions and geoengineering can be regarded as exhibiting public goods characteristics since their impacts will affect not only the countries that engage in these activities but the globe through the impacts of climate change. Therefore, in the absence of a supranational government that could enforce the required cooperation, solving such a coordination problem at a planetary scale requires new institutions (Walker et al, 2009). So far, the economic literature does not allow being very optimistic about the possibility of attaining and sustaining international agreements to reduce greenhouse gases emissions. Quite the contrary, with some exceptions (Nordhaus (2009)), this literature has not produced up to date a type of international treaty to reduce GHG emissions that can be robust to the free-rider problem and at the same time be sustained over time (see for example, Barrett (2003) and Finus et al (2013)); even under tipping points (Barrett ( 2013)).

These dismal results produced by the theoretical (and the experimental literature) even without explicitly considering political economy aspects of climate change (Dietz, et al, 2013), or less-developed-country contexts in which drivers of political commitment to take actions in this direction may be hindered by some additional barriers, as compared with developed countries. Following Greenstone and Jack (2013), one of these barriers may simply be their low income level. People in developing countries, for example, may place a low present value on current GHG reductions (because of a high marginal utility of current consumption), and therefore not be willing to support government policies to engage in reducing GHG emissions. The design of optimal climate policies across location and the differention of the carbon taxes across poor and rich location has been studied in the context of spatial energy balance climate models (Brock et all 2013a, 2013b). This work can also be used as a stepping stone for analyzing global environmental policies. Moreover, the lack of institutional capacity of less developed countries may also be added to the list of characteristics that may hinder the development and implementation of international agreements; particularly those requiring important monitoring efforts, such as the type of agreements that are based on economic instruments (Russell and Vaughan, 2003). The interrelation of institutional and political economy aspects have been at the heart of the explanation why past domestic initiatives based on economic instruments did not sustain themselves through time (Caffera, 2011).

On the other hand, environmental protection observed in the real world may be argued to be more than what the theoretical models based on opportunistic, profit and utility maximizing individuals would predict (Kolstad, 2011). In a similar fashion the work of E. Ostrom (1990) has shown as that there are a set of community and institutional characteristics that are positively associated with the probability of averting the tragedy of the commons predicted by Hardin (1968) or the collective action problem predicted by Olson (1965). Moreover, besides the lack of an effective international cooperation agreement, some countries or groups of countries are taking considerable measures to tackle global warming (like the EU ETS, similar examples inside the US, etc.

The objective of this research project is to contribute to the understanding of the barriers impeding the commitment of policy makers with sustaining international cooperation on actions conducting at the mitigation of GHG emissions in particular and cooperating in more general actions, including adaptation, against climate change in our Latin American countries, and the proposal of new solutions that could break these barriers. The project aims to contribute also to answering which of these barriers could be the most important if we want to implement the needed coordination policies at the right pace. Examples of such barriers to be considered are: the measurement of wellbeing and GDP, the architecture of international agreements, the individual’s preferences for policy actions and the role of science communication and education, uncertainty, tipping points and catastrophes, the distribution of impacts across countries in shaping these preferences.

The present Project aims to attain these objectives by gathering a set of prominent scholars from several parts of the continent and beyond, along with environmental policy makers in the countries involved in the study and other stakeholders:

# Outline of the body of literature that might inform research in a future Transformative Knowledge Network.

Arrow, K. J., P. Dasgupta, L. H. Goulder, K. J. Mumford and K. Oleson (2012). Sustainability and the measurement of wealth. *Environment and Development Economics*, 17, pp 317-353.

Barrett, S. (2013), “Climate treaties and approaching catastrophes”, *Journal of Envrionmental Economics and Management* 66, pp. 235-250.

Barrett S., Timothy M. Lenton, Antony Millner, Alessandro Tavoni, Stephen Carpenter, John M. Anderies, F. Stuart Chapin III, Anne-Sophie Crépin, Gretchen Daily, Carl Folke, Victor Galaz, Terry Hughes, Paul Ehrlich, Nils Kautsky, Eric Lambin, Rosamond Naylor,Karine Nyborg, Stephen Polasky, Marten Scheffer, James Wilen, Anastasios Xepapadeas, and Aart de Zeeuw (2014), “Climate engineering reconsidered,” *Nature Climate Change*, forthcoming

Brock, W., G. Engström, D. Grass and A. Xepapadeas (2013a) “Energy Balance Climate Models and General Equilibrium Optimal Mitigation Policies”, *Journal of Economic Dynamics and Control,* 37, 2371-2396.

Brock, W., G. Engström, and A. Xepapadeas (2013b) “Spatial Climate-Economic Models in the Design of Optimal Climate Policies across Locations”, *European Economic Review*, in press, http://dx.doi.org/10.1016/j.euroecorev.2013.02.008.

Caffera, M. (2011). "The use of economic instruments for pollution control in Latin America: lessons for future policy design", *Environment and Development Economics*, Volume 16, Special Issue 03: 247-273.

Colander, D. and R. Kupers (2014). Complexity and the Art of Public Policy. Solving Societies Problems from the Bottom Up. Princeton University Press. Princeton and Oxford.

Dietz, S., C. Marchiori and A. Tavoni (2013), “Domestic politics and the formation of international environmental agreements”, *Grantham Research Institute on Climate Change and the Environment Working Paper No. 87.*

Greenstone, M. and B. K. Jack (2013), “Envirodevonomics: A Research Agenda for a Young Field”, Working Paper 13-19, Department of Economics, Massachusetts Institute of Technology.

Hansen, J. (2010), Storms of My Grandchildren, New York: Bloomsbury Press, Paperback edition.

Joighin, I., B. E. Smith and B. Medley (2014), “Marine Ice Sheet Collapse Potentially Under Way for the Thwaites Glacier Basin, West Antartica”, *Science* 344 (6185), pp. 735-738.

Kolstad, C. (2011) “Bridging Reality and the Theory of International Environmental Agreements”, paper prepared for the Symposium in Honor of Tom Schelling. Available at <http://fiesta.bren.ucsb.edu/~kolstad/HmPg/papers/Schelling.pdf>

[Olson, M.](http://en.wikipedia.org/wiki/Mancur_Olson) (1971) [1965]. The Logic of Collective Action: Public Goods and the Theory of Groups. Harvard University Press.

Ostrom, E., (1990), Governing the Commons. The evolution of Institutions for Collective Actions, Cambridge University Press.

Russell, C. S., & Vaughan, W. J. (2003). The choice of pollution control policy instruments in developing countries: arguments, evidence and suggestions. *International Yearbook of Environmental and Resource Economics, 2003/2004*, 331-371.

Walker, B.H., Barrett, S., Polasky, S., Galaz, V., Folke, C., Engström, G., Ackerman, F., Arrow, K., Carpenter, S., Chopra, K., Daily, G., Ehrlich, P., Hughes, T., Kautsky, N., Levin, S., Mäler, K-G., Shogren, J., Vincent, J., Xepapadeas, T., de Zeeuw, A. (2009), “Looming Global-Scale Failures and Missing Institutions”, *Science* 325, pp. 1345-1346.

# Applicant’s experience with trans-disciplinary methodologies. Motivation for the significance of such an approach in the proposed context of application.

Member and past Chairman, Board of Directors, The Beijer Institute of Ecological Economics, The Royal Swedish Academy of Sciences

Past President, The European Association of Environmental and Resource Economists,

Editor, *Environment and Development Economics,* Cambridge University Press

# Countries and regions to be included in an eventual Transformative Knowledge Network proposal

List of countries: Uruguay, Chile, Colombia, Costa Rica, Holland, Greece.

# Other knowledge partners (academic and non-academic, specifying names (where possible), institutions and/or sectors) to be engaged in each case; if relevant, an indication of the nature and extent of existing working relations with these partners should be provided.

Already contacted and agreed to participate as partner: **Marcelo Caffera**: working at the Department of Economics of the **University of Montevideo**. Marcelo has prepared this proposal with me. He will be a member of the team. And he is the going attending the Potsdam workshop. **Juan Pablo Montero (Catholic University of Chile), Carlos Chávez (University of Concepción, Chile), Juan Camilo Cárdenas (University of the Andes, Colombia)**.

Partners not-contacted but that will be contacted: **Omar Defeo (University of the Republic)**. Omar is internationally re-known biologist working on systems of co-management fisheries. **Walter Baethgen (University of Columbia)**. Director of the Latin American Program at IRI – Earth Institute, Walter is an expert in climate and agricultural policy issues. **Marten Schefer (University of Wageninghen)**. Schefer’s research is focused on the dynamics of ecosystems and social systems. He is also at the board of the South American Institute for Resilience and Sustainability (SARAS), located in Uruguay. **Juan Robalino (CATIE, Costa Rica)**

# Description of the strategy to be employed for purposes of engaging these partners in the co-design of a Transformative Knowledge Network proposal, including anticipated partnership opportunities and obstacles, and how to overcome the latter.

All these partners are very well known colleagues. We do not anticipate any obstacle in the possibility of developing a partnership with these colleagues in the co-design of the Network.

# Detailed description of proposed activities and a related work plan.

Work plan:

1. Development of modeling framework: this part of our work would consist mainly in developing the conceptual framework through we are going to analyze the mentioned barriers for collective action.
2. Explore the development and the design of appropriate policies: based on our conceptual framework, we will construct theoretical models to develop policy recommendations. An important part of this project would be the co-design of these policies with relevant stakeholders (policy makers) and testing of these policies in the lab or the field, when possible.
3. Apply our modeling framework to specific case studies. One of the main barriers behind the lack of commitment of policy makers with policy measures aiming at reducing GHG is the costs that these measures could impose on regulated parties and citizens, and their corresponding effects on social discontent, given the preferences for climate stability. This is specially a problem for the kind of economic instruments advocated by environmental economists, such as a tradable market in emissions allowances. In this sense, another instrument that could change the norms or tastes could be at the same time more effective and politically viable (Colander and Kupers, 2014). We plan to test the effectiveness of several of these instruments in the lab or in the field. For example, the effect of communication of climate change risks on the consumption of fossil-fueled energy in homes, in different countries, by income level, could be tested in the field using a randomized control treatment. In a lab experiment, we would test the relative effectiveness of a carbon tax versus a non-economic instrument on emissions of sources and their voting behavior towards the corresponding governments.

Proposed activities:

1. Initial sandpit among partners of the network.
2. Mobilization of researches to facilitate research
3. Workshops with policy makers from each of the countries included in the Network co-explore and co-design policy alternatives.
4. Lab experiments/randomized control treatments

# Budget, with clear indication of budget categories and related expenses.

What does the call says:

*“The following types of activities and associated expenses will be considered for support:*

*a) Economy fare travel and accommodation for meetings with knowledge partners and*

*field visits to potential research sites, communities, institutions that will be central to*

*the proposed work.*

*b) Workshops (e.g. scoping meetings, sandpits, action labs) with potential*

*Transformative Knowledge Network participants or contributors, including*

*researchers from other fields or countries, decision-makers, practitioners and other*

*potential knowledge partners.*

*c) Overhead costs, which should not exceed 15% of the total budget and may include a*

*contribution towards administrative assistance.*

*To note: All applications should include the costs of the applicant attending the*

*September 2014 Transformations Knowledge Workshop mentioned in Section 1 above.*

*Such costs will include an economy return fare to Potsdam, Germany, as well as € 300,00*

*for three nights’ accommodation.”*

# Attachaments

* 1. A short (maximum five pages) CV of the applicant, including a list of the five most relevant publications to the proposal
	2. A written indication of availability and commitment to participate in the Transformations Knowledge Workshop in Germany in September 2014

Regrettably, I will not be able to attend the Transformations Knowledge Workshop in Germany in September 2014. Our team will be represented by Marcelo Caffera.