Sustainable development and climate change governance in Latin America: some contributions from a New Institutional Economics approach[*]

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Abstract

Traditional economic approaches to environmental problems consider them as efficiency dilemmas. Within this framework, most climate policy recommendations based on economic approaches have been aimed at `fixing the right prices´ in order to make polluters internalize the social costs they impose to society. Nevertheless, it can be argued that climate change poses complex challenges beyond efficiency considerations. It poses many uncertainties and simultaneous policy, institutional and equity dilemmas all which call for a more comprehensive approach. This is particularly acute from a developing country´s perspective, given their specific configuration of historical, political and institutional factors, economic development levels, natural resource dependence and high vulnerability to climate change. In this sense, a New Institutional Economics approach can shed some light by helping understand how natural resources and their vulnerability to climate change create interdependence and conflict among users in resource-dependent countries and how this could be solved by creating and/or modifying environmental governance and institutions for sustainable development. As a case study, this paper aims at analyzing the interest of this approach when defining and reviewing climate change governance in Latin America. Specifically, it analyzes the role of national governments (at all levels) and of supranational institutions in order to achieve regional development goals while complying with international climate architecture mandates and responding to adaptation needs.

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Contents

1. Introduction

Climate change is and will probably be the most serious long-term global environmental problem the world community has ever faced. It is defined by the United Nations Framework Convention on Climate Change (UNFCCC)[1] as `a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods´ (UNFCCC, 1992; art. 1). It has serious environmental, socioeconomic, political and equity implications since its impacts and their associated economic and political costs and benefits are and will be unevenly distributed among countries and generations, thus posing huge challenges to international cooperation (Stern, 2006; IPCC, 2007).

Mitigation and adaptation are the two main lines of action that have been internationally defined to tackle climate change (UNFCCC, 1992). `Mitigation´ refers to any human intervention aimed at reducing the sources of greenhouse gases (GHG) or improving its sinks[2] while `adaptation´ refers to the adjustments in natural or human systems as a response to real or expected climate changes and their effects, with the aim of reducing damages or taking advantage of beneficial opportunities[3].

Analytically, from an economic perspective, climate change has been traditionally conceived as an efficiency dilemma that could be solved either by optimization exercises or through game theory approaches. Actually, this is the way all environmental problems have been tackled in traditional economic analysis. In this context, most climate policy recommendations have been aimed at `fixing the right prices´ in order to make polluters internalize the social costs they impose to society.

However, climate change poses many simultaneous policy and institutional challenges, uncertainties (mainly regarding expected impacts and associated costs) and intra and inter-generational equity dilemmas that go beyond efficiency considerations. Therefore, a more comprehensive analytical approach is needed to consider climate change socioeconomic and development implications, even from an economic perspective.

[1] The UNFCCC was one of the three conventions resulting from the "Rio Earth Summit" held in 1992, together with the UN Convention on Biological Diversity and the Convention to Combat Desertification.
[2] A `sink´ is any process, activity or mechanism that absorbs a greenhouse gas from the atmosphere (UNFCCC, 1992). Oceans and forests are the two main examples.
[3] These definitions are available at www.ipcc.ch

Such a comprehensive approach is particularly necessary from a developing country´s perspective, because their specific configuration of historical, political and institutional factors as well as their severe dependence on natural resources strongly condition their response to climate change.

In this context, it can be argued that an approach from New Institutional Economics (NIE) can shed some light by going beyond traditional economic analysis. This school of thought departures from traditional Economics in two main points. Firstly, its analysis of environmental problems is based on the notion of `interdependence´ in an intent to go beyond the classical concept of `externality´. Interdependence exists when the choices of one agent influences the choices of another and vice versa. Along these lines, the idea of `externality´ (ie. an effect caused unilaterally on an agent by another who did not take the choices and interests of the former into account) would be an instance of interdependence. Secondly, NIE acknowledges that transaction costs exist and that they influence economic outcomes. This means recognizing that the implementation of policies or solutions inevitably involves costs that must be considered because they influence economic outcomes. On the contrary, the traditional economic approach assumes that the introduction of policies is done in an ideal context where transaction costs are zero. The NIE also takes explicitely into account the equity and distributive implications of choosing among different institutional arrangements.

The analysis of interdependes among agents and in relation to natural resources is key when analyzing the climate change problem and the political ways to tackle it. This is due to the fact that there are profound dilemmas when defining adaptation priorities and selecting among mitigation options, mainly which interests are to prevail given the fact that choices are not neutral regarding costs, benefits and equity implications. In this context, the NIE approach can help understand how natural resources and their vulnerability to climate change create interdependence and conflict among users in resource-dependent countries and how this could be solved by creating and/or modifying environmental governance and institutions for climate change and sustainable development.

Along this lines, this paper aims at analyzing the conceptual contributions this theoretical approach can make when defining and reviewing development and climate change governance institutions in developing countries. As a case study, the paper focus on Latin America.

In general terms, what it is argued in this paper is that economic approaches should pay more attention to governance issues as a key aspect of climate change policy design. Most of the time economic analysis assume that any optimal instrument can be implemented in any circumstances, ignoring the fact that the underlying governance mechanisms do no not always permit it.

The paper is organized as follows. Section 2 summarizes the main general features of the climate change problem. Section 3 briefly describes and presents the limitations of the traditional economic theory approach to climate change and other environmental problems. This section also presents a summary of the salient points of the current academic and political `consensus´ regarding environmental governance. Section 4 revises some key conceptual contributions from the NIE approach that are highly relevant to consider the complex challenges posed by climate change. This section also presents a conceptual model for analyzing governance design in relation to environmental problems. In Section 5 the contributions of the NIE outlined in the previous section are applied to the Latin American case. Firstly, the salient characteristics of natural resources dependence in Latin America are analyzed as well as the main climate challenges the region faces. Secondly, the main interdependence relations that should be taken into account by the governance structure in the region are identified. These interdependences refer both to the links among Latin American countries and also between the region and the rest of the world, especially developed countries. Thirdly, the above-described NIE analytical framework for designing governance arrangements is adapted to the Latin American reality, in an intent to stylize the main climate and development governance challenges facing the region. Finally, Section 6 concludes.

2. The climate change problem

According to the Intergovernmental Panel on Cimate Change[4] (IPCC), global average temperature will increase between 1.1° C and 6.4° C during the next century. This will generate more frequent heat waves, changes in rain patterns, more floods and droughts, more destructive hurricanes and increases in sea level as a consequence of glacier melting. Inevitably, this will affect the availability of key resources for human life

[4] The IPCC was created in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP) with the aim of providing consensuated scientific information regarding climate change.

such as drinking water, energy and agricultural production as well as global biodiversity (IPCC, 2007).

Climate change causes are to be found in the excessive accumulation of GHG in the atmosphere[5]. This is due both to natural and human processes. The latter are mainly related to the rapid growth of developed countries since the end of the Second World War, especially their fossil fuel intensive-use pattern (Stern, 2006; IPCC, 2007, Chichilnisky, 2006).

In contrast, as it can already be seen, developing countries will be the ones who will suffer most acute climate impacts, not only due to physical factors but also to socioeconomic and political reasons (IPCC, 2007): developing regions are already warmer than developed regions, they experience more variability in rain patterns, they depend almost entirely on agriculture (the most climate-sensitive economic sector), their income levels are low, their public and health services are inadequate and they face restrictions regarding infrastructure and financing. These factors make them highly vulnerable to climate catastrophes (World Bank, 2010; Stern, 2006).

All of the above means that the climate change problem poses several concerns involving basic issues of economic development and well-being as weel as food and energy security. Therefore, the issues at stake are not simply about reducing GHG emissions but rather to reduce emissions while ensuring that the world will not be left without adequate supplies of energy to maintain high levels of production and consumption and that developing countries will make progress in their development processes. And it is precisely because of this need of balancing competing interests that for some analysts climate change constitutes the most difficult collective action problem humanity has ever confronted. This term describes a situation in which multiple individuals would benefit from a certain action that has associated costs that make it implausible for isolated individuals to solve it alone (Cole, 2009).

Within this framework, in 1992 the UNFCCC was adopted. Its ultimate objective was to stabilize GHG concentrations `at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system´ (UNFCCC, 1992). This treaty compelled developed countries (those belonging to the Organization for Economic

[5] Six types of GHG are considered in the Kyoto Protocol. Some of them are natural gases (carbon dioxide, methane and nitrous oxide) and others are industrial gases (HFCs, PFCs y HF6).

Cooperation and Development - OECD) to stabilize emissions in 1990 levels by the year 2000.

It was in this context that the Kyoto Protocol was adopted in December 1997, entering into force in February 2005. The Kyoto Protocol constituted the first global effort aimed at reducing developed countries´ GHG emissions (only developed countries assumed quantitative mitigation commitments for the period 2008-2012).

Today, negotiation processes regarding international action for the post-2012 period are being carried out within the UNFCCC framework. In the 17th Conference of the Parties of the UNFCCC held in Durban in December 2011 (COP 17) it was agreed that a second commitment period will be adopted, although neither its extension nor the specific mitigation goals to be assumed by countries have yet been defined.

3. Climate change analysis: traditional Economics´ approach

Economic theory began to analyze climate change-related issues in the eighties, with the pioneering work of Nordhaus (1982). He was the first author to set out that biological and geophysical resources use should be analyzed within a cost-benefit framework just like any other economic activity.

During the nineties, the literature related to the climate change problem grew notably, until it became a specific branch of Environmental Economics. This new theoretical area was named `the Economics of Climate Change´.

The Economics of Climate Change has based its analysis on the theoretical background of traditional Economics. This approach focuses on establishing the `right prices´ of scarce (environmental) resources in order to assure an efficient use of them. From this approach, climate change constitutes a global long-term negative externality, ie. a cost not transmitted through prices that is incurred by a party who did not agree to the action causing the cost. In the specific case of climate change, this means that (without intervention) no market prices reflect the global social costs of GHG emissions and thus no incentive exist to reduce them. As it was already mentioned, this externality was derived mainly from the fossil-fuel combustion and use that has taken place in developed countries since the Industrial Revolution (Azqueta, 2002; Kolstad,

2001; Stern, 2006; ECLAC, 2010, 2009; Samaniego, 2009; Galindo and Samaniego, 2010; Chichilnisky, 2006).

In this sense, limiting climate change effects can be seen as the equivalent of providing a global public good (climate protection), since every country would benefit from the international efforts aimed at mitigating climate change (non-exclusion principle) without diminishing the benefits for the rest of the countries (non-rivalry principle). However, this public good characteristic of the climate change phenomenon poses two problems. On the one hand, the current (private) provision level of a clean atmosphere is sub-optimal. Terefore, a non-market correction is needed. On the other, some countries may adopt a free-rider behavior, trying to take advantage of the benefits of avoiding climate change without affording the costs of reducing GHG emissions at domestic level (Kolstad, 2001; Azqueta, 2002; Stern 2006).

In this context, traditional economic analysis of the climate change problem has focused on three main issues:

Firstly, the climate change problem has been considered an optimal regulation dilemma where policy makers should identify the `optimal´ level of GHG emissions based on a social cost-benefit analysis. The main assumption behind this approach is that reliable valuations of marginal mitigation costs and of marginal damages are available. This type of analysis is described in section 3.1.

Secondly, economic analysis has applied game-theory tools to stylize the main interaction and strategic action dilemmas posed by climate change (efficiency versus equity, developed countries versus developing nations, incentives for achieving cooperation, etc.). This approach is analyzed in section 3.2.

Section 3.3 summarizes the main limitations of this traditional theoretical framework.

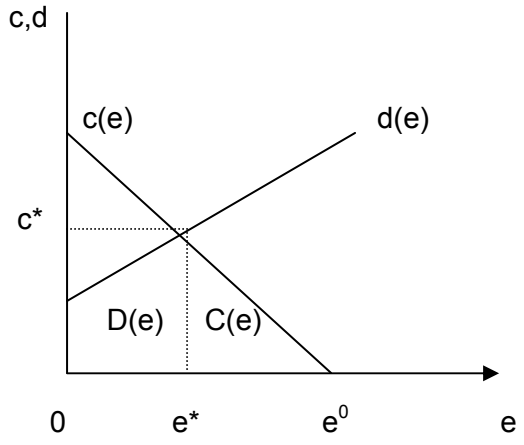
Finally, there is a growing literature that analyzes climate change from a governance perspective, i.e. focusing on the institutional arrangements that are needed to deal with environmental problems such as climate change. In addition, there is a vast literature that tackles climate change from a political economics perspective, arguing that optimal instruments cannot be always applied due to transaction costs and political acceptance difficulties. This approach is summarized in section 3.4.

3.1 Optimization and policy instruments selection

Traditional Economics (following Pigou, 1920) considers environmental problems as externalities or physical effects between agents for wich no price is paid and no compensation is received. When externalities prevail, efficient allocation of resources is not achieved. In this context, if social welfare is to be maximized, generators of negative externalities should pay a tax.

Analytically, this approach tackles environmental problems by designing and solving mathematical exercises where welfare is to be maximized or costs are to be minimized. In the case of climate change, the analysis begins by considering a benevolent regulator that seeks to maximize social welfare by selecting a level of GHG emissions (e) that minimizes the sum of the damages generated by emissions in monetary terms -D(e)- plus mitigation costs -C(e)-. The social optimal point is reached when the marginal damage of emissions -d(e*)- equals the private marginal mitigation cost -c(e*)-. At this point there is a balance between the environmental damage that emissions cause to society and the mitigations efforts that firms should undertake (Azqueta, 2002; Kolstad, 2001). This analysis is graphically explained in Figure 1.

Figure 1
Optimal level of emissions



With this information, direct regulations and/or market instruments are designed in order to reach the optimal level of emissions (e*). e* can be reached either by applying a price instrument (a tax or subsidy -c*- per unit of emission or mitigation effort, respectively) or by a quantity instrument (an emission standard e* or a tradable permits system that distributes e* permits among polluters).

The assumptions behind this theoretical scenario are mainly two: i) the regulator can choose optimal instruments to correct negative externalities and ii) firms can comply with regulations affording minimal transaction costs (Azqueta, 2002; Kolstad, 2001; Stern, 2006).

As it was mentioned above, the analytical framework that underlies beyond this optimization exercise is cost-benefit analisis (CBA). CBA aims at identifying and valuing the total economic effects (costs and benefits) generated by a project or policy option, discounting the expected future flows with a certain discount rate (Azqueta, 2002; Kolstad, 2001).

In the case of climate change, CBA implies evaluating if the benefits of reducing GHG emissions (avoided damages and potencial co-benefits of implementing mitigation measures, such as increased energy efficiency or less local pollution) would be higher or lower than the economic costs of the potential impacts of climate change plus the costs of implementing mitigation measures (Stern, 2006).

The main example of CBA application to climate change analysis has been provided by the so-called `Stern Review´ (Stern, 2006). This report was the first global economic analyses of climate change and it demonstrated that in the next 100-200 years the benefits of mitigating climate change would be much higher (five times) than the costs of doing so. After this pioneering report, similar analysis began to be developed in different parts of the world (UNFCCC, 2009). With regards to Latin America, in 2008 the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) coordinated economic analysis of climate change in several countries of the region (ECLAC 2009, 2010; Samaniego, 2009; Galindo and Samaniego, 2010). They showed that that the net average costs of climate change impacts could reach 34%-137% of regional 2007 GDP.

Selecting an appropriate discount rate is one of the main debated issues in cost-benefit analysis of climate change. This is mainly due to the fact that it is the present generation who should pay the costs of implementing mitigation (and adaptation) measures but the future generations who will mainly benefit from them. Therefore, discount rate selection is not only a technical issue but also, and fundamentally, an equity matter. High discount rates give low values to future damages and future benefits derived from implementing mitigation and adaptation measures now, therefore

`playing against´ the environment and future generations. On the other hand, low discount rates imply higher sacrifices for present generations (Weitzman, 1998; Newell and Pizer, 2001, 2002; Philibert, 2003; Stern, 2006; Dasgupta, 2008; Dietz, 2008).

3.2 Climate change and game theory

Game theory is a tool for the study of the behavior of interacting decision makers. Specifically, the theory analyzes `rational´ decision making, since this is felt to be the most appropriate model for most economic behavior (see Varian, 1992 and Gibbons, 1992).

Game theory has been widely used in Economics in the last decade and much progress has been made in clarifying the nature of strategic interactions of agents in economic models. As a matter of fact, most economic behavior can be currently viewed as special cases of game theory.

A game is defined by exhibiting a set of players, a set of strategies, the choices each player can make and a set of payoffs that indicate the utility that each player receives if a particular combination of strategies is chosen. The strategies should be something that players can be committed to or that are difficult to change once the opponent´s behavior is observed (for example, in the case of climate change, the strategies at stake could be to Cooperate or to Defect in mitigation efforts).

In fact, game theory is a generalization of standard, one-person decision theory. It analyzes how a rational-expected utility maximizer should behave in a situation in which his payoff depends on the choices of another rational-expected utility maximizer. Therefore, in order to make a sensible choice, each player has to consider the problem faced by the other player. Sometimes, the interests of the players are diametrically opposed. This situation is simple to analyze as a zero-sum game. However, most games of interest are not zero-sum games.

In order to solve a game a set of strategies should be found that are, in some sense, in equilibrium. The equilibrium concept is often thought of as a `rest point´ of some adjustment process. The natural starting point in a search for an equilibrium solution is standard decision theory: it is assumed that each player has some probability beliefs about the strategies that the other player might choose and that each player chooses

the strategy that maximizes his expected payoff. In other words, each player wants to maximize his expected utility given his beliefs about what the other player might do. However, each player in the game knows that the other player is out to maximize his own payoff and each one should use that information in determining what are reasonable beliefs to have about the other player´s behavior (Varian, 1992; Gibbons, 1992).

A `Nash equilibrium´ is a minimal consistency requirement to put on a pair of strategies. It consists of a pair of strategies such that each agent´s choice maximizes his expected utility given the strategy of the other agent. No player would find it in his interest to deviate unilaterally from a Nash equilibrium strategy. If a set of strategies is not a Nash equilibrium then at least one player is not consistently thinking through the behavior of the other player, i.e. he expects the other player not to act in his own self-interest, contradicting the original hypothesis of the analysis. One interpretation of the Nash equilibrium is that it is the adjustment process of `thinking through´ the incentives of the other player. A Nash equilibrium is then a set of beliefs and strategies in which each player´s beliefs about what the other player will do are consistent with the other player´s actual choices (Varian, 1992; Gibbons, 1992).

Games may have different structures. The simplest ones are one-shot games and repeated sequences of one-shot games. These have simple information structures: each player in the game knows the other player´s payoffs and available strategies but does not know in advance the other player´s actual choice of strategies. However, in many games at least some of the choices are made sequentially and one player may know the other player´s choice before he has to make his own choice, ie. some choices are made before others. Once a choice has been made in these types of games the players are in a subgame consisting of the strategies and payoffs available to them from then on. In addition, games may have incomplete information, ie. one agent may not know the payoffs of the other agent (Varian, 1992; Gibbons, 1992).

With regards specifically to climate change, to date a number of research papers have applied game theory to model the problem of international climate negotiations, mainly trying to explain the failure of countries to reach a global agreement regarding reductions in GHG emissions. A priori, game theory seems a good approach since international climate negotiations are strongly driven by strategic interdependences (for example, what developing countries are willing to commit -including Latin America- depends on what developed nations are willing to commit). Some of the main game-

theoretic treatments include Barrett (1991; 2003), Maskin (2003), Nordhaus and Yang (1996), Carraro and Siniscalco (1993), Carraro and Moriconi (1998), Hovi (2002), Buchner and Carraro (2009), Chander and Tulkens (2009), Wood (2010), Stoft (2010) and Hsu (2011).

In general, this literature states that the problem behind international climate negotiations is the problem of one country waiting to see what another country will do, which profoundly affects the decision environment for other countries. In this context, cooperating is a rational choice only in a cooperative outcome in which costly mitigation is undertaken. Without reassurance that other countries will cooperate, it is extremely difficult for one isolated country to undertake a cooperative course of action (Hsu, 2011).

The simplest models of climate negotiations are static prisoner's dilemma problems[6], in which two individuals (or nations) might not cooperate even if it seems that it is in their best interest to do so. These models capture the collective action problem but not the intertemporal effects of actions. Other game-theoretic models of climate negotiations have been incorporated into sophisticated economic models that simulate the optimal path of GHG mitigation for different countries over long periods of time. These models usually divide the world into regions consisting of one or more countries (the United States and China are generally `regions´ by themselves) and they model the optimal amount of GHG abatement over time horizons of 50 to 100 years. The game-theoretic component tipically involves decisions at two stages: a stage in which formations of coalitions are made among regions agreeing to reduce emissions and a second stage in which an optimal emissions level is chosen by coalitions and countries that did not join a coalition in the first stage. These models are heavy on the economic analytics but they neither test different game-theoretic assumptions nor do they explore how outcomes might change as assumptions change. In addition, information asymmetries suggest that perhaps climate negotiations should be best modelled as a dynamic game of incomplete information, since there is mutual mistrust among negotiating parties (Hsu, 2011).

[6] The classic example of the prisoner's dilemma game describes the decision conflict of two men that are arrested and kept separated. The police offers both of them a similar deal: if one testifies against the other (defects) and the other remains silent (cooperates), the betrayer goes free and the cooperator receives the full one-year sentence. If both remain silent, both are sentenced to only one month in jail. If each betrays the other, both receive a three-month sentence. Each prisoner must choose either to betray or remain silent. What should they do?

In particular, some game-theoretic models illustrate the powerful effect of free-riding. Nordhaus and Yang´s (1996) RICE model (Regional Integrated Model of Climate and the Economy) and the so-called `WITCH´ model (World Induced Technical Change Hybrid model)[7] are the two main models in this regard. Both involve large numbers of players (twelve `regions´ of the world, each comprising countries with similar economic and emissions profiles) and they state that cooperation is extremely difficult to achieve. Both models assume that since there can be no incentive to join a cooperating coalition of regions, the only incentive to cooperate consists in having a slightly better chance to avoid climate change. But this is minimized by free-riding. In the WITCH model, free-riding plays an almost determinative role in whether countries can successfully cooperate to achieve an optimal mitigation path (Hsu, 2011).

Another classical reference regarding climate change negotiations modelling is Barrett (2003), who sets out the principles of a theory on what is needed to achieve a successful international agreement to reduce GHG emissions. He concludes that the way to solve the twin problems of participation and enforcement is to agree on two main issues: the research and development of funding to lower the costs of GHG reduction and the technological standards needed to create network incentives for adoption. Joining the agreement would therefore be an economic necessity.

In a similar conceptual line, Hovi (2002) explores a number of lessons from non-cooperative game theory that could be relevant for effective enforcement of climate agreements. The main conclusion of the paper is that, in order to minimize non-compliance, a compliance mechanism should take into account the following three insights: i) relatively severe consequences to deter non-compliance; ii) consequences not only need to be severe, but also individually rational to implement; iii) regime on climate change needs to curb not only individual but also collective (subgroup) incentives to cheat.

A last model that is worth commenting is Hsu (2011). This author proposes a simple two-player (United States and China), three-period game of perfect information: two periods in which the players decide to undertake or not undertake mitigation measures to reduce GHG emissions and a third in which the countries will suffer damages from climate change if mitigation efforts in the first two periods are unsuccessful. The players move simultaneously in period one and again in period two, and the costs of mitigation in period two depend upon how much mitigation is undertaken in period one.

[7] http://www.witchmodel.org/pag/model.html.

The game highlights two key factors that determine whether a country would be inclined to undertake mitigation actions or not: the country's climate change damages and its discount rate. While the damages only affect the likelihood that a country will be inclined to mitigate, the discount rate affects both the inclination to mitigate as well as the timing of doing it.

3.3 Some limitations of the traditional economic approach to climate change

Many analysts have highlighted that the climate change problem is too complex to be analyzed within the traditional economic theoretical framework just described, mainly because it poses many policy challenges, uncertainties and equity dilemmas. These difficulties are aggravated by the fact that climate change involves multiple and heterogeneous agents (sovereign states with different development levels and historical responsibilities with regards to climate change generation, heterogeneous firms, international organizations, markets, lobby groups, vulnerable and non-represented communities, etc.), which have multiple incentives. This generates pressures that make it extremely difficult (and costly) to reach an agreement (UNFCCC, 2009).

In particular, equity is a crucial issue that is not always taken into account in the economic analysis of climate change, although it determines the applicability of any policy option. This is due to the fact that since climate change is a global problem, there is no supranational institution with enough athority to dictate world policies. Therefore, each nation is absolute sovereign to accept or reject any internationally proposed line of action. This means that although the economic analysis may conclude that a certain policy is optimal (i.e., that it minimizes global costs) no nation or group within a nation will accept a proposal that make them net loosers or that they, simply, consider unfair. Besides, given that climate change impacts will affect disproportionately the most vulnerable groups, they should be protected even though the costs of doing so may seem to exceed the benefits (UNFCCC, 2009).

Therefore, a new analytical framework that can facilitate the achievement of a constructive and fair global solution is needed. Along these lines, climate change analysis should take carefully into account the historical responsibility of each country in the climate change problem genesis, the different levels of vulnerability each region

faces and the real possibilities of each economy of affording mitigation and adaptation costs.

With regards specifically to the analytical tools, there is growing criticism (see for example Stockstrom, 2004) regarding the limitations of CBA to take into account the environmental, social, political, distributive and equity dimmensions of climate change mainly due to two reasons. Firstly, CBA gives priority to monetary estimates of all costs of climate change (human lives loss, life quality deterioration, ecosystems and biodiversity destruction, relocation and uprooting of entire communities, etc.). Since they are extremely difficult to estimate (not only technically but mainly conceptually) these considerations are generally excluded from the analysis. As a result, the total costs of possible climate change impacts are most of the time underestimated. And secondly, the CBA allows multidimensional prioritization -i.e., considering the simultaneous contributions of a certain action to different political areas (for example, the economic, social and environmental dimensions of climate change)- only of those issues that can be valued in monetary terms.

There are also some criticism in relation to the discount rate used in cost-benefit analysis: a slight change in it changes the optimal course of action (Weitzman, 1998; Newell and Pizer, 2001, 2002; Stern, 2006). Therefore, the sensitiveness of the results of optimization exercises is so high that it is very risky to trust them as an absolute basis for decision making.

With regards to game theory, it is highlighted that the complexity of the climate change problem is such that no single model can capture all the relevant subgames of strategic behavior at stake (Weitzman, 2008). In addition, most models assume perfect information (which is definitely not a realistic assumption) or deal with uncertainty by introducing asymmetric information. However, the problem of climate change is plunged into many `absolute´ uncertainties, such as scientific uncertainty about the possible impacts of climate change and their exact timelines, over climate change damages and their economic cost, over how nations will react politically and practically to climate change, over the speed and timing of technological innovations that may help adaptation and mitigation in the future and over the outcomes of future negotiations. In this context, the game-theoretical approaches developed so far do not have the ability to capture the fundamental interrelationships among these uncertainties and the way they may influence economic choices. In this sense, although models are indeed useful to highlight the most important decisions, behaviors

and interactions at stake, they fail to identify and suggest comprehensive policy solutions due to their over-simplified design (Hsu, 2011).

The profound conceptual criticism that lays behind all these arguments is that the enormous complexity of the climate change problem, the lack of quantitative data, the multiple uncertainties and the opposed incentives make it very difficult to imagine that the dilemmas climate change impose could be solved by rational optimization. Instead of this behavioral assumption, many analysts suggest applying bounded rationality, ie. the idea that in decision-making individual rationality is limited by the cognitive limitations of the mind, the available information and the finite time human beings have to make decisions (Simon, 1986; Akerloff, 1984; Arrow, 1986; McFadden, 1998; Kahneman and Tversky, 1979, 2000; Rabin, 1998; Thaler, 1999).

Summing up, the traditional economic approach is useful for analyzing certain aspects of the climate change problem but it is not enough for understanding comprehensively its policy and equity challenges. Neither does it help in identifying the particularities involved in the design and implementation of global, regional and national policy solutions.

This is due to two main facts. Firstly, traditional analysis ignores the role of institutions, failing to understand that they are key factors in the determination of policy results: if institutions are not well designed, they may not be able to solve conflicts and troublesome interactions, therefore hampering the implementation of `optimal´ policy instruments. In other words, environmental regulations (such as carbon taxes or emission permits) are neither designed nor implemented in a vacuum: environmental policy is conceived within a non-neutral institutional framework and a certain national and international context that determine policy results (Powell and Russell, 1997). Secondly, traditional economic approaches fail to recognise some strategic interdependences among countries (both developing and developed) and their relationship with natural resources. Countries´ natural resource dotation is a key determinant of the level of vulnerability to climate change, the capacity to tackle its challenges, the interactions with the rest of the world and, consequently, the success of any international arrangement.

In this context, it is further argued that the NIE approach can shed some light on these issues. The conceptual pillars of this school of thought are analyzed in Section 4. But before entering into this different theoretical dimension, the salient points of the

available literature regarding environmental governance arrangements is summarized in the next subsection.

3.4 Climate change governance: current theoretical consensus

Traditionally, economic-based analysis tends to recommend assigning decision-making and policy-implementation to different government levels according to their efficiency levels, in order to count with available information and handle the problems adequately. With regards to environmental issues, centralization or decentralization is suggested according to the scale of the environmental dilemma. If there is a problem of local air pollution, local or municipal governments may face it effectively. In contrast, if there is some conflict around a shared resource (for example, a river or lake), then provincial or regional authorities would be better suited to deal with it (Chidiak and Gutman, 2011).

In the case of climate change, decision-making and policy implementation comprise multiple and simultaneous relevant instances. On the one hand, as seen above, given the global nature of the climate change problem, objectives and actions should be agreed at a global scale in order to be effective (and avoid, for example, free-riding behavior). On the other hand, these global objectives should necessarily be implemented through national, regional and local policies. Some of them require careful information gathering, evaluation, coordination and financing that can only be achieved at national scale (for example, to make decisions over energy and sanitary policies or long-distance transport infrastructure investment) and some other require less national involvement (for example, local public transport, energy efficiency, etc.) (Chidiak and Gutman, 2011).

This means that climate change strategies aimed at evaluating and prioritizing mitigation and adaptation options should be elaborated at national scale but should count on the cooperation and the detailed information that can only be provided by local actors, i.e “think global, act local”. Therefore, in the definition and implementation of strategies a combination of different levels of government, decision-making and different actors (such as enterprises, civil society, NGOs, etc.) is necessary (Chidiak and Gutman, 2011).

The recent literature about local government and climate change highlights that cities offer multiple mitigation opportunities and, at the same time, face the most dramatic

challenges of climate change. On the one hand, cities concentrate the highest shares of GHG emissions and, therefore, exhibit many mitigation alternatives. Specifically, in Latin America there are different options involving low-carbon infrastructure on which local governments can have a bearing (for example, sustainable energy, energy efficiency, sustainable transport, sustainable methods of waste treatment, etc.). After reducing deforestation and forest degradation, these options are considered the most important mitigation options in developing countries. On the other hand, vulnerability of regional population to climate change depends on the way adaptation has been included in urban-development planning as well as on the response capacity to reduce poverty and the exposition levels of the poorest people. Therefore, local management is fundamental to tackle climate change adaptation challenges, especially with regards to four lines of action: energy, transport, waste treatment and land use (UN Habitat, 2011; Kern y Alber, 2009; Corfee-Morlot et al, 2009).

At a more general level, the specialized literature states that current governance processes are neither designed nor prepared to deal with the political and institutional challenges climate change poses to democratic countries. Politicians are doubtful about introducing reforms that may not be welcomed by voters (for example, increases in energy taxes) and economic groups with high lobby power can use their influence to protect their interests and avoid change. In addition, the press plays an ambivalent role by simplifying and polarizing the debate. In this context, the inclusion of climate change in the political agendas needs a new vision with regards to adjustment and innovation in governance practices (Corfee-Morlot et al, 2009; Meadowcroft, 2009).

Existing governance structures related to climate change are extremely young. Some developed countries have introduced GHG emission-control systems but the political experience in this area does not exceed twenty years. Therefore, societies are just learning which approaches seem to be more or less promising. This means that with regards to climate change we are still lacking of a `best-practice governance handbook´ in order to transfer lessons from one country to the other (Corfee-Morlot et al, 2009; Meadowcroft, 2009).

Nevertheless, the available literature seems to agree on a key point: strenghtening multi-level approaches involving local governments´ participation and a centralized coordination with an active participation of key decision-makers seem to be fundamental to tackle climate change adaptation challenges and achieve a trajectory

change towards a more sustainable, less carbon-intensive development path (Corfee-Morlot et al, 2009; Meadowcroft, 2009; Ostrom 1990, 2005, 2009).

However, what it is missing is a particular conceptual framework for identifying the main features of such approach, which should take carefully into account the existing young climate change governance structures and the prevailing uncertainties and lack of information.

4. Contributions from New Institutional Economics

New Institutional Economics is an interdisciplinary school of thought that encompasses findings from Economics, Political Science, Sociology and Anthropology and it mainly evolved as a critique of mainstream welfare economics.

The term `New Institutional Economics´ is currently associated to a vast literature that differs from the `old´ economic institutionalism of Veblen (1899, 1914, 1919, 1934), Commons (1924, 1934, 1950) and Mitchell (1967), which dominated in American Universities´ Economics departments during the first postwar period. This `old´ institutionalism has been frequently condemned and rejected for not being able to accommodate a reasonable approach to economic theory (Hodgson, 2003).

Since its beginings, NIE has tackled issues such as industrial organization and risk management (Coase, 1937, 1960, 1974; Williamson, 1996, 1985; Calabresi, 1961, 1970, 1991), economic development and economic history (North, 1981, 1990; Ostrom 1990, 2005, 2009; Clague, 1997; Platteau, 2000) and public choice (Mueller, 1989).

Its analytical efforts were not focused on environmental issues until the nineties, when some authors began to study governance dilemmas related to common property goods and international environmental conventions (Baland and Platteau, 1996; Berge and Stenseth, 1999; Bromley, 1992; Keohane and Ostrom, 1995; Ostrom, 1990; Ostrom *et al.,* 2002; Ostrom, Gardner and Walker, 1994; Young, 1994, 2002a, 2002b). All this work has shed some light on the conditions under which voluntary collective action can attain sustainable use of natural resources and has identified design principles that characterize succesful governance solutions and institutions. The concept of `institution´, according to Williamson (2000), includes all mechanisms of social order and cooperation that range from informal arrangements (customs, traditions, religions,

social norms and even some aspects of language) to political systems, government and financial organizations, human and property rights, legal systems and market structures.

However, the challenges and solutions of governing large and complex environmental problems and resources such as atmospheric sinks are still incipient research objectives within the NIE. In addition, very little work in this line of analysis considers national environmental governance in developing countries (Paavola and Adger, 2006).

In this context, it is of particular interest to consider the theorical developments of Paavola (2006), Paavola and Adger (2006) and Ostrom (2009), who outline conceptual revisions of the NIE theory in order to extend this approach from its current local and international domains of application to all environmental governance problems. The next paragraphs are mainly based on these contributions.

Conceptually, the NIE differs from traditional Economics in two central points. Firstly, as it will be explained in subsection 4.1, its analysis of environmental problems is based on the notion of `interdependence´ instead of on the idea of `externality´. Interdependence refers to the reciprocal influence agents´ choices have on each other. Secondly, as it is presented in section 4.2, NIE acknowledges that transaction costs exist and that they influence economic outcomes. This means considering the costs of implementing policies instead of assuming that policy design is done in an ideal costless context. In addition, NIE conceptualizes governance dilemmas as issues of social justice. This is analyzed in subsection 4.3. Here, a reflection about different equity notions and how they lay behind the main climate change international architecture proposals is also presented. Finally, section 4.4 presents a NIE-based model for analyzing environmental governance design.

4.1 The notion of `interdependence´

The starting point for understanding the main conceptual differences between the NIE and traditional Economics regarding the environment is how each school of thought considers and defines environmental problems.

As we mentioned before, traditional Economics considers environmental problems as unilateral externalities between agents for wich no price is paid and no compensation is received.

For the NIE, the traditional approach has failed to recognize externalities as instances of interdependence. As it was already explained, interdependence exists when the choices of one agent influences the choices of another. For example, factories that bench smoke affect laundries nearby (this is a classical example of `externality´). But if the options of laundries are kept open, then the options of factories are limited.

Since interdependent actors cannot usually realize their interests simultaneously, conflict emerges, especially with regards to the use of environmental resources. These conflicts have to be resolved by defining whose interests are to prevail and to what degree, and this is achieved by establishing, reaffirming or changing governance institutions. Governance institutions can either be formal or informal and can either be implemented at national or international levels. They may involve the creation of new organizations (eg, environmental agencies), the delegation of authority to existing agents or both. Sometimes, governance does not entail the presence of government, for example when natural resource users govern themselves under customary institutions. However, other times (as in the case of climate change) the State is involved.

Coase (1960) acknowledged that interdependence lies beyond Pigou´s concept of externality and he argued that transaction costs should be accounted for, but his analysis did not go any futher, especially with regards to questioning the goal of welfare maximization. Coase demonstrated that under Pigou´s own assumption of costless transactions, the assignment of private property rights to one of the parties is all that is needed to reach efficient allocation of resources without government intervention, since parties will bargain between themselves after the initial endowments are defined. This is the essence of the so-called `Coase theorem´. Nevertheles, Coase also demonstrated that when transaction costs are introduced, the assignment of property rights can influence and in fact determine the allocation of resources. He also argued that, when a large number of actors is involved, environmental regulations to define property rights can entail lower transaction costs than private negotiation.

From the NIE viewpoint, assigning property rights is a way of solving interest conflicts over resources. Therefore, this is not an issue of efficiency but rather of distribution, ie. an equity dilemma.

According to the NIE, environmental resources have certain attributes which significantly affect the challenges and available solutions for governing them. The most important is their non rivalry/non excludability combination. However, it should be also considered their ability to be applied to multiple uses, their mobility, their stability or fluctuation of yields and their capacity for being storaged. These characteristics imply different types and levels of interdependence among agents (both national and international and both private and public) that dispute their access to them as well as their use and exclusivity.

To date, NIE has mostly focused on common-pool resources as a source of interdependence. These type of resources have two defining physical attributes: rival consumption and the difficulty of exclusion. Many environmental resources are included in this classification: small-scale ones such as forests, pastures and fisheries and also larger ones such as bodies of water and the global atmosphere. These resources need special governance solutions. Forests and fisheries, for example, in some places are still governed by customary common property arrangements. With regards to the global atmosphere, as we have already seen, it needs both international agreements and national voluntary arrangements, together with certain regional coalitions.

There are also other sources and types of interdependence which require different kind of governance solutions. Ordinary private goods, with rival consumption and easy excludability, have traditionally been governed by property rights. On the other hand, environmental resources such as biodiversity and landscape amenities, which are jointly offered, need different types of governance arrangements in order to guarantee some quantity and quality conditions. Here, focusing on guaranteeing provision to accommodate certain preferences and uses implies ignoring others.

Furthermore, interdependence can be created and shaped by the attributes of the involved and affected community. Here, the defining attributes that affect governance solutions mainly include the number of involved agents, the heterogeneity of their values and the conflicting interests and powers.

In summary, from the NIE viewpoint, interdependence among agents causes environmental conflicts, which can be solved by establishing, modyfing or reaffirming institutions. As interdependence may involve a varying number of agents and different geographic scales, it influences directly the scope of appropriate institutional solutions. Local solutions may not be adequate when interdependence is national or global. On the other hand, if interdependence is local, national, regional or international solutions may be dysfunctional and wasteful. Finally, when interdependence is complex, as in the case of climate change, governance solutions may need to be carried out at multiple levels or through multiple governance institutions. This means that there may not be a single, optimal level of intervention for environmental governance.

Institutions solve environmental conflicts by striking a particular balance on environmental resources entitlements. This inevitably has distributive consequences. From the NIE perspective, these distributive outcomes are the key variables at stake in collective environmental decisions. And this means that the choice among different social arrangements implies solving equity dilemmas. These issues are analyzed in section 4.3. But before entering into this subject, the next section briefly explains the other main conceptual departure of the NIE: the acknowledgement of positive transaction costs.

4.2 Positive transaction costs

When trying to explain the existence of the firm, Coase (1937) defined `transaction costs´ as the costs of using the market system. Afterwards, other authors included in this definition the costs of seeking information, conducting negotiations, writing up contracts, monitoring and enforcing compliance. However, environmental governance consists largely of non-market transactions, mainly administrative transactions. These, in turn, entail costs related to collecting information, making decisions, formulating institutional (and other) rules, monitoring compliance and enforcing these rules (Paavola and Adger, 2006).

Transaction costs have important implications for environmental governance mainly because they make it impossible to design governance institutions perfectly *ex ante*. The rights structure generated by institutions will always inevitably omit some interdependences and it will also fail to tackle new ones that could not be anticipated at the time governance institutions were established. When these interdependences

result in environmental conflict they have to be addressed *ex post* in court or in other social arenas and may sometimes involve changes in governance institutions (Paavola and Adger, 2006; Paavola, 2006).

Transaction costs also influence the effectiveness and outcomes of environmental governance. Attributes of environmental resources such as size, the number of uses and users and their rivalry or non-rivalry condition imply different governance costs and this, in turn, influences the choice of institutional responses and determine the performance of institutional alternatives.

More generally, transaction costs influence the role of the State in environmental governance. Depending on the scope of the interdependences involved, a functioning State may often have relative advantages in terms of transaction costs *vis-a-vis* other institutional solutions.

To sum up, the recognition of positive transaction costs enables a more detailed analysis of the interaction between policy problems and the formulation of institutional responses. Policy problems are determined by the physical attributes of the involved environmental resources and the attributes of their users. These, in turn, largely determine the level of transaction costs. But at the same time transaction costs can be influenced and redistributed by the choice and design of institutional solutions. This also helps understanding the implications of particular institutional designs for implementation and effectiveness.

4.3 Governance dilemmas: an issue of social justice

The conceptualization of environmental problems as conflicts of interests over environmental resources implies that the choice of governance institutions is not a matter of efficiency but rather of equity, ie. of determining what outcome is `fair´. The main problem here is that what is considered `fair´ in particular institutional choices depend on the different values and motivations of different agents.

Typically, NIE shares the conventional economic assumption that agents seek to improve their personal welfare or utility. However, some authors (such as Paavola, 2006) consider that a deeper treatment of values and motivations is needed in order to better understand environmental conflicts and their potential resolution.

Following Paavola (2006), one plausible starting point is the acknowledgement of equity pluralism, ie. the co-existence of incommensurable premises of behavior. This means that some agents may pursue a particular governance solution because of its assumed positive welfare consequences but others who are not centered in their own economic self-intrerest may consider that some of its consequences are worth pursuing even if it would require welfare sacrifices.

In this sense, three main equity paradigms can be identified in the literature that can be useful to analyze climate change dilemmas: Utilitarism, Libertarianism and Liberal political philosophy (see Arnsperger and Van Parijs, 2002).

Utilitarism (based on Jeremy Bentham´s and John Stuart Mill´s ideas) was the exclusive and explicit equity reflection framework for economists from the 19th century to the 1970´s. In simple terms, Utilitarism states that in a fair society only individual welfare matters. Therefore, actions, policies and institutions should not be evaluated according to their intrinsic nature (i.e., the intention that has inspired them) but rather by their results. This means that, when deciding between two options, their consequences regarding the utility of each member of society should be evaluated. Then, welfare levels should be aggregated and the option that maximizes such sum (i.e., the one that generates the highest collective welfare) should be choosen. The main criticism Utilitarism faces is precisely related to its distributive approach, since an exclusive focus on the addition of utilities implies indiference regarding inequality.

For Libertarianism (mainly represented by authors of the Austrian School such as Ludwig Von Mises, Friedrich Hayek and Murray Rothbard) a fair society is a free society. In contrast to Utilitarism, Libertarianism´s objective is not to provide a complete moral theory but rather to characterize fair institutions. Therefore, if individual behaviors are morally acceptable or not is not a type of question this apprach tries to answer. This means that Libertarianism does not evaluate policies according to their effects on society´s happiness but rather it analyzes if they respect and protect individuals´ fundamental rights. In this sense, in order to determine whether a situation is fair or unfair, the past should be examined with the aim of identifying if the present is the product of a correct proceeding where actions and transactions have been developed respecting three main principles: i) self-determination; ii) voluntary and fair transfers and iii) originary appropriation, i.e. he who first claims a property right (on a natural resource, for example) will be the original owner, provided that he leaves enough

quantity of the resource (and of the same quality) for the rest of the present and future individuals. Therefore, within this approach there is no place for economic analysis and tools, since the aim is neither to assign resources optimally nor to identify, measure or aggregate preferences or utility levels. As long as everybody´s rights are rigorously respected, it does not matter whether institutions or policies are detrimental to the welfare of some individuals or, even, of everybody. With regards explicitely to institutions, Libertarianism only requires a minimal State able to assure property rights.

Finally, for the Liberal political philosophy (mainly represented by John Rawls), a fair society is a free and egalitarian society, i.e. one in which there is respect for different conceptions regarding what `good life´ is and, at the same time, efforts are made to make sure that each citizen has the means to achive such state. Rawls employs a number of thought experiments in order to determine principles of social justice and what constitutes a fair agreement in which everyone is impartially situated as equals. The most famous one is the `veil of ignorance´, which makes abstraction of the real social position of individuals making them choose among options under the assumption that one could be in the worst condition.

In this context, Blanchard *et al* (2001) apply this different equity frameworks to the analysis of the international debate regarding future climate change architecture. They state that behind each position there are different moral principles regarding how each country (and individuals within a country) see and conceptualize the functioning of the world.

From the Utilitarian perspective, the `fair´ solution to the climate change problem would consist in maximizing the global economic growth net from the adverse effects of climate change, even though these effects concentrate in a limited number of regions. These regions should `sacrifice´ for the world´s welfare sake. In this sense, countries should be free to decide how much emission reduction they are willing to compromise according to their individual preferences. With regards to the distribution of mitigation efforts, they should be determined by equalizing marginal costs among countries, therefore minimizing the total cost of reductions. From this theoretical point of view, efforts should concentrate on those countries and economic sectors with the highest low-cost mitigation potential, although these countries may neither be the richest nor the main GHG emitters. In other words, from an utilitarian perspective, `fairness´ means `efficiency´. This solution would be compatible with the international proposals

focused on technological transfer and sectorial approaches such as the `Global Triptych´[8] or the `extended Clean Development Mechanism (CDM)´[9].

With regards to the Libertarian conceptualization of `justice´, within this theoretical approach present or historical emissions would represent an `inherited or acquired right´ of each country. Therefore, future distribution of emission rights should respect these original entitlements, no matter the perpetuation of historical inequalities regarding the use of the atmosphere. In this sense, this ethical conception would be compatible with the international proposals aimed at establishing Kyoto-like mitigation goals, setting future reduction objectives according to the historical or current emissions of each economy.

Finally, for a Liberal political philosopher the fairest arrangement would be to defend the interests of the less favoured people, because if their condition improves then the final situation would be fairer than the initial one. If we consider the atmosphere as a `primary social good´, this approach would recommend maximizing its use by those in the worst situation, i.e. the poorest countries and, generally, those with the highest population. In this sense, Liberal political philosophy principles would be in line with those policy proposals favouring emissions distribution according to population-related criteria (per capita rights) and/or GDP-related criteria (emission intensity).

Summing up, behind the different positions stated in the global climate change architecture debate there are different equity conceptions regarding the best way of distributing internationally costs and responsibilities. Each proposal implies a different way of conceptualizing the world, revising History and understanding social justice. Therefore, there cannot exist a unique arrangement that could satisfy simultaneously the whole planet. This is the real issue behind the challenge of designing and implementing climate change governance arrangements.

[8] The Triptych approach focuses on mitigation actions in three sectors: electricity generation, energy-intensive industries and “domestic sectors” (including residential and transport). It was originally used to share the burden of the Kyoto targets within the European Union (UNDP, 2008).

[9] The CDM is one of the Kyoto Protocol flexibility mechanism that allows cooperative action between countries that have a cap on emissions (developed countries) and those that do not (developing countries). For the time being, CDM mainly functions on a project basis. Extending the CDM implies evolving to programmatic CDM (programme basis) or even to sectorial CDM (sector basis) (UNDP, 2008).

In the next subsection, a NIE-based model is presented with the aim of contributing to stilize the issues at stake in the international debate and help conceive a suitable climate-related institutional design, both at the national and international level.

4.4 A model for analyzing environmental governance design

Paavola (2006) proposes an analitycal framework for designing environmental governance institutions that can be useful for analyzing climate change and development challenges especially in resource-dependent regions such as Latin America.

The central aspects of this framework are mainly three: institutions, functions and rules. Specifically, the model requires analyzing: i) functional and structural tiers of institutions; ii) organization of governance functions and iii) key institutional rules.

The functional and structural tiers of institutions refer to three levels of action or hierarchy of the decision system on which governance institutions rely. They are: i) the operational level, where individuals make choices within the constrains of rules that define their choice sets; ii) the collective level, where authorized actors make collective choices regarding what is and what is not acceptable based on `institutional rules´ and iii) the constitutional level, where decisions are governed by constitutional rules. Some governance solutions (such as common property arrangements) exhibit the three functional levels but are frequently based on single-level institutions. However, today many governance solutions exhibit both the three levels of action and a multi-level structure. Multi-level governance solutions emerge either because an upper level of governance is established in order to coordinate lower-level tiers or because lower levels of governance are established to implement higher-level strategies. In addition, they may emerge to realise economies of scale and scope in the implementation of some governance functions such as exclusion and provisioning. It is worth pointing out that there are always degrees of freedom among the levels of governance in multi-level solutions, because at each level the surrounding institutional framework partly determines what the effective rules are.

Secondly, the concept of `governance functions´ include the following typology: i) exclusion of unauthorized users; ii) regulation of authorized resource uses and distribution of their benefits; iii) provision and recovery of costs; iv) monitoring; v)

enforcement; vi) conflict resolution and vi) collective choice. Different governance solutions organize these governance functions differently. For example, in a small common property regime, resource users are often members of a community such as a village which makes and enforces the rules of resource use. The community performs all governance functions without separation of powers and the users can particitipate directly in environmental decision-making. On the other hand, formal national environmental policies entail deeper division of labour between government organizations and agencies and a different organization of functions at different levels. Finally, international environmental conventions can be seen as constitutions for special-purpose jurisdictions which have their own decision-making, monitoring and implementation bodies and specific conflict resolution processes.

Different governance solutions perform broadly similar functions but organize them in different ways, which have particular transaction costs implications. In this sense, the nature and scale of the governance problem, the interdependences it implies, the institutional design of government solutions and its transaction costs implications are the key determinants of the choice and performance of governance solutions. In this context, multi-level solutions emerge when governance functions such as collective choice or provision are best organized at different spacial levels.

Finally, `institutional rules´ mainly comprise i) rules of exclusion, which influence how unauthorized users can be excluded from usufructing the resource; ii) entitlement rules, which mainly affect the distribution of benefits of resource use; iii) monitoring rules, which determine what is being monitored and by whom and iv) decision-making rules, which determine whose interests will be recognized, who can participate in environmental decisions and what rules and procedures must be observed when making decisions. They have implications not only on transaction costs but also on distributive justice and on the performance and legitimacy of governance solutions.

This analytical approach can help analyze the key aspects of governance institutions design and can help determine the social justice implications of different environmental governance solutions.

In the next section, this framework is applied to the Latin American reality and an analytical approach based on this set of categories, roles and functions is proposed.

5. Climate change and development governance challenges in Latin America: a NIE-based analytical approach

In this section the conceptual contributions of the NIE outlined in the previous pages are applied to the Latin American case. Firstly, the most salient characteristics of the natural resource-dependence in Latin America are analyzed as well as the main climate challenges the region faces. Secondly, the main interdependences that governance institutions should tackle in the region are identified. Thirdly, the above-described NIE analytical categories for designing governance arrangements are adapted to the Latin American case, in an effort to provide a framework to stylize the main elements climate governance institutions in the region should not overlook.

5.1 Latin American configuration of economic, environmental, political and institutional factors

This section explores the most salient Latin American economic, social and natural resource-related characteristics. It first analyzes the main regional socioeconomic features and the peculiarities of its dependence on natural resources and next it explores the most serious climate challenges the region faces.

5.1.1 Latin American socioeconomic profile and natural resource-dependence patterns

Latin America is characterized by wide economic and development gaps, excessive resource depletion and high regional inequalities exacerbated by the allocation of rents.

In the region there are still 174 million poor inhabitants and 73 million extreme-poor human beings, although poverty and inequality have been reduced in the past few decades and exhibit now the lowest levels in the last 20 years. In effect, poverty rates fell from 48,4% to 31,4% between 1990 and 2010, extreme poverty rates fell from 22,6% to 12,3% in the same period and the Gini Index, a measure of inequality through income or wealth dispersion, fell 2% annually in countries such as México, Venezuela and Uruguay and 1% annually in countries such as El Salvador and Peru between 2008 and 2010. These reductions have been mainly due to labour income increases and, to a lesser extent, to the rise in public transferences towards the most vulnerable sectors. However, these economic and social achievements are being threatened by

the remaining gaps in the productive structure and by the functioning of labour markets, which generate low productivity employment without social protection in the region (ECLAC, 2011).

With regards to natural resources, since colonial times Latin America has been structured around external needs, at first European and then also North American. This made the region center its economic activity on natural resource exploitation and export, with the consequent concentration of rent and power. Gold, silver, sugar, coffee, cocoa, rubber, fruits, tobacco, meat, leather, wool: each Latin American country has historically identified itself with the items it produced and it has produced items according to the mandate of the colonial or trade powers. Resources were depleted, natives and African black slaves were systematically and brutally exploited, capitals flew away and the scarce money that rested in the region did not generate European-like accumulation processes, ie., it did no lay the foundations of industrial development but rather it immobilized in the purchase of new pieces of land and revolved in commercial and speculative activities (ECLAC, 1988; Bulmer-Thomas, 1998; Gligo and Morello, 1980; Fajnzylber, 2006; De Filippo, 1988; Galeano, 1971; Ramos, 1968).

Today, Latin America is still an important global source of natural resources, especially non-renewable ones such as hydrocarbons and minerals. Therefore, commodities still play an important role in regional economies, which is reflected both in their share of total exports and in their contribution to public sector revenues. For example, oil explains 80% of total exports in Venezuela and almost two thirds in Trinidad and Tobago while in other countries such as Bolivia, Chile, Colombia and México natural resources contribute with more than 20%. Consequently, rents from natural resources reach substantial levels in many Latin American countries and income appropriated by governments represent an important share of public revenue. To give an example, in Venezuela revenues from oil account for more than 50% of total income and high shares are also found in Bolivia, Ecuador and Trinidad and Tobago (Brosio and Jiménez, 2010).

In the context of the increasing concern regarding climate change, energy supply and consumption and the impact of fossil fuel burning on GHG emissions have become a first-order issue in international relations agenda and this is impacting on Latin American countries. According to international agencies, oil, gas and coal will continue to be the main components of the global energy matrix during the next decades. However, this will occur in a new international context where production and supply of

fossil fuels will be governed by a new paradigm of high prices and volatility, stronger geopolitical tensions, intensification of the international environmental debate, rivalry with regards to access to new regions, demands for higher participation in hydrocarbons rents, increasing merges and acquisitions and extremely high profits (Ruiz Caro, 2007). This will make world providers of natural resources play a strategic global role regarding energy security.

It is worth pointing out that conflict surrounding natural resources is usually exacerbated by `contextual circumstances´ such as global economic and financial crises. At these times, political and economic struggles for gaining access to key resources usually grow and, at the same time, social distrust augments.

Climate change is also posing several world challenges with regards to food security. This is especially acute in most Latin American countries, where agriculture plays a crucial role in internal food provision, contribution to GDP and exports and economic dynamism in general. Given the high sensitiveness of this sector to climate factors, it is one of the most vulnerable to climate change. Decrease in agriculture productivity and consequently of global food supply is expected. Therefore, Latin American countries face a double challenge in this regard: on the one hand, they have to guarantee national food provision and on the other, they have to sustain their international role as a global food source (Samaniego, 2009).

Within the national contexts, Latin American countries also face increasing conflict regarding access and use of natural resources and regulation of extractive activities (increasing regional demonstrations against mining are the best examples). This is due to the fact that there are strong interdependences among inhabitants regarding exploitation of resources and the allocation of rents, both among private agents and between the private and public sectors. It is expected that these conflicts will aggravate as climate change impacts intensify and limit access to land, water and food.

With regards specifically to the allocation of rents derived from the exploitation of natural resources in Latin America, the internal dilemmas countries face are both theoretical and practical. On the one hand, if rents are assigned exclusively or with preponderance to subnational governments, this potentially creates huge horizontal imbalances across subnational jurisdictions which, in turn, stimulate political pressures and provide theoretical grounds for national equalization of these resources. On the other hand, if entitlements to natural resources revenues are transferred to the national

government, local populations´ perceived risks of having to bear the costs of exploitation without reaping the benefits generates increased demand for decentralization of powers and resources. In this context, recent decentralization trends have expanded the institutional role of subnational governments and have increased their demand with regards to revenues generated within their jurisdictions. In addition, territories whose populations have distinct ethnic characteristics, such as the Andean highlands, are also increasingly claiming higher shares of the benefits derivated from natural resources exploitation. This means that if national governments are incapable of harmonizing competing claims, natural resources increase political strains and exacerbate regional disparities (Brosio and Jiménez, 2010). Needless to say, this situation is expected to be strongly aggravated in a climate change context.

Summing up, climate change effects are being increasingly considered at the global level as a national security issue both from an energetic and food perspective. In this context, developing countries exhibiting high dotation of natural resources (such as Latin American ones) are facing incrasing pressures regarding their access and use, both at the international and national levels. In the next section, the most salient challenges imposed by climate change on Latin American countries are briefly explained.

5.1.2 Regional climate change challenges

Latin America is a relatively small global GHG emitter: it contributes with only 12% of world emissions, solely more than Africa. Neverheless, in per capita terms some countries of the region -such as Mexico, Chile and Argentina- contribute to world emissions more than other developing countries, including China and India. In addition, since the seventies there has been a growing tendency in regional absolute emissions. This is consistent with the increasing energy consumption and production patterns observed in the region in the last decades (ECLAC, 2009, 2010; Samaniego, 2009; Galindo and Samaniego, 2010).

The main characteristics of regional GHG emissions can be summarized in four main points (ECLAC, 2010).

Firstly, total average per capita emissions reached seven tonnes in 2004 (although there are important differences within countries). This means that if a per capita

emissions goal of two or three tonnes was imposed (as it is being favoured in some international initiatives), this would be lower than the current regional average.

Secondly, with regards to regional emissions composition, Latin America exhibits a lower proportion originated in energy consumption than the rest of the world. However, land use change-related emissions (including deforestation) are more relevant.

Thirdly, regional emissions trajectory exhibits two opposite features. On the one hand, land use change-related emissions (also including deforestation) still explain a significant proportion of total emissions (in fact, the region is a key world contributor). On the other hand, energy consumption-associated emissions showed a constant growth between 1990 and 2004 but they still explain a small share of regional emissions.

Finally, Latin American energy matrix generates relatively few carbon emissions (in the international comparison) due in part to the importance of hydro energy.

Nevertheless, in spite of the low regional contribution to global emissions, Latin America is particularly vulnerable to the introduction of restrictions in international trade based on export-associated GHG emissions. This is due to the fact that the region is specialized in high carbon-content exports. Needless to say, there are important individual differences with regards to environmentally-sensitive industries participation within countries. Chile, Trinidad and Tobago and to a lesser extent Peru and Venezuela exhibit export profiles with the highest participation of environmentally sensitive industries. Therefore, they are highly vulnerable to the imposition of environmental restrictions. On the other hand, Costa Rica and México´s productive structures exhibit higher technological content, being less vulnerable. In the rest of the countries the situation varies. In some of them, such as Argentina and Brasil, the productive profiles are mostly equilibrated, with environmentally-sensitive and technological industries showing a relatively similar participation. Anyway, in spite of the obvious differences among countries, sectors, regions and industries, the Latin American export pattern is increasing the difficulties of the region to respond to the growing climate exigencies of international markets (Samaniego, 2009).

The truth is that developed countries[10] (the only ones that for the time being have assumed quantitative mitigation goals) are worried about two issues. On the one hand, they fear competitiveness losses (especially in their energy-intensive industries) due to developing countries´ not facing environmental restrictions. On the other hand, they are worried about the growing emission patterns of developing countries -specially China, India, Brazil and Mexico- since a higher participation of these economies in global emissions will restrain the possibility of developed countries of using the atmosphere as an international sink. Therefore, developed countries are imposing growing pressures on the developing world in an intent to force the latter to assume mitigation commitments similar to theirs. They are also discussing the introduction of some conditionings to the import of developing countries´ carbon-intensive products and they have introduced some standards related to product-associated carbon emissions (for example, in the case of biofuels). All this is expanding the issues included in the international trade negotiations agenda (World Bank, 2008; WTO/UNEP, 2009; Hoppstock, 2010).

With regards to adaptation needs, many countries of the region are highly vulnerable to the potential effects of climate change. Latin America is in part located on the hurricane strip, it contains many insular states and low coastal zones, it depends on Andean ice-melting for providing water to vast urban and agricultural sectors, it is importantly exposed to floods and forest fires and agriculture has a deep incidence in its productive structure (ECLAC, 2009, 2010; Samaniego, 2009).

The most expected (and feared) consequences of climate change in the region are the following: i) significative reductions in agricultural productivity in some areas, with severe impacts on food security and exports; ii) important changes in water quality, quantity and availability for human consumption, agriculture and electricity generation; iii) coastal zones damages due to increases in sea level, which could be equivalent to 0,54%-1,3% of regional GDP; iv) highest incidence of coral bleaching and reef mortality and, consequently, less ecosystem services (this will imply high economic costs specially for the Caribbean region); v) higher economic damage due to more intense and frequent hurricanes and tropical storms (given the increase in air and sea-surface temperatures); vi) biodiversity losses due to the extintion of several species in most tropical areas and vii) gradual conversion of tropical forests into savannas in the Amazonia region (ECLAC, 2010).

[10] Included in Annex I of the UNFCCC.

Regarding climate change costs, as it was already mentioned, the available documents (ECLAC 2009, 2010; Samaniego, 2009; Galindo and Samaniego, 2010) show diverse national realities but, in general terms, estimate that the average costs of climate change impacts could reach 34%-137% of regional 2007 GDP (depending on the selected climate scenario).

Needless to say, these expected impacts wll affect notably development possibilities in Latin America and, particularly, they wil be an important obstacle for achieving the United Nations Millenium Development Goals. Therefore, investments in adaptation infrastructure are increasingly being considered of highest priority within regional economic and social development strategies.

5.2 Main interdependences to be taken into account when designing climate change-related institutions in Latin America

On the basis of what has been presented above, this section aims at identifying the three main types of interdependences that governance institutions in the region should tackle: economic, equity and `effectiveness´ interdependences. These refer both to the linkages among Latin American countries and between the region and the rest of the world.

5.2.1 Economic interdependences

Economic interdependences in Latin America (in relation to climate change) are mainly summarized in four points:

i) Natural resources in the region play a key role regarding energy and food security, both within national territories and with regards to the rest of the world.

ii) Developed countries need cheap mitigation options available in the region in order to fulfill their emission reduction commitments. In most economic sectors -except from transport- more than 50% of global mitigation potential seems to be located in developing countries. In particular, in the industry, forestry and agriculture sectors almost 70% of global emission reduction potential would involve opportunities in the developing world (De la Torre *et al*, 2009).

iii) The region highly depends on developed countries´ financing for implementing adaptation and mitigation measures.

iv) It may be said that the region, for the time being, benefits from the current international division of responsabilities: as long as only developed countries face mitigation commitments, Latin America is in risk of neither loosing competitiveness nor witnessing industry migration due to disparate environmental regulations. However, increasing pressures from developed countries aimed at forcing the developing world to assume similar mitigation commitments threatens this `competitive advantage´.

5.2.2 Equity interdependences

Equity interdependences refer mainly to three facts:

i) Developed countries are historically responsible for climate change, namely for the accumulation of GHG emissions in the atmosphere since Industrial Revolution times;

ii) Nevertheless, developed countries are less threatened by climate risks than developing countries (including Latin America);

iii) Developed countries are in better position to afford and finance adaptation and mitigation measures in developing countries but they are not keen on doing so, especially in the current global crisis context.

5.2.3 `Effectiveness´ interdependences

Finally, `effectiveness´ interdependences refer to the fact that UNFCCC objectives could only be fulfilled if every country in the world is part of the global effort to reduce GHG emissions. No country or even group of countries can solve the climate change problem alone. Coordinated action is absolutely necessary and countries (including Latin American) perfectly know that their participation in an agreement is a necessary, but far from sufficient, condition to the consummation of an effective international agreement to reduce GHG emissions (De la Torre *et al*, 2009; Cole, 2009).

Summing up, Latin American countries´ economic dynamism is mainly based on natural resource exploitation, which makes many of them highly vulnerable to the potential effects of climate change in spite of the fact that the region is not an important global GHG emitter (especially compared with China, the European Union or the United States). There are many cheap mitigation opportunities located in the territory and the participation of the region is needed in order to reach an efficient and effective global mitigation arrangement. However, in different scales and intensities, Latin American countries are not willing to bear with the weight of implementing costly mitigation measures unless international financing is available, since the historical responsibility of climate change is developed countries´. It is simply not fair.

This configuration must be kept in mind when analyzing and designing climate governance arrangements in the region. On the one hand, interdependences among Latin American countries and the rest of the world regarding natural resources constitute a potential source of conflict and ignoring this fact augments the probability of failure in achieving a global equilibrium. On the other hand, Latin America has still not solved her own resource depletion problems derived from her natural resource-based pattern of development. In this sense, the creation of climate change institutions aimed at protecting resources from Nature´s threatens as well as from external irrational exploitation may play a double role regarding resource preservation that will be crucial for moving onto a more sustainable development path.

In the next subsection a NIE-based framework is proposed for stylizing these issues.

5.3 Applying a NIE framework to analyze climate change governance in Latin America

Identifying the types and scales of interdependences involved in the climate change problem at regional level is the first step for designing adequate governance arrangements. Governance institutions, functions and rules should tackle every possible source of environmental conflict at the time they are designed, in order to maximize efficiency and effectiveness and minimize failure probabilities.

Following Paavola (2006), the next step in governance-building involves analyzing the three levels of action on which governance institutions rely: the operational, the collective and the constitutional levels.

As it was mentioned above, the operational level of institutions refers to the choices individuals make. In this sense, the truth is that the average Latin American citizen is not much politically involved in climate-change related issues. There is not much consciousness regarding the importance of protecting natural resources (except from some punctual demonstrations against specific projects) and there is not much awareness yet of the relevance of reducing GHG emmisions and adapting to climate change. There are some national programmes and campaigns aimed at changing consumers´ and entrepeneurs´ energy-consumption behaviour, some autonomous adaptation measures are being taken mainly in the agricultural sector and some companies (mainly big transnational enterprises with head offices in developed countries) are taking the lead with regards to undertaking `green´ operations. Nevertheless, individuals are still far from behaving the way is needed to achieve a sustainable path of low-carbon development. A clear lead from public institutions together with a right incentive-structure aimed at gaining consciousness and changing individual behavior patterns is needed (see Stern, 2006).

The collective level of institutions refers to the hierarchy of the decision system in which authorized actors make collective choices. In this regard, in most Latin American countries it can be seen that Environment Ministries and Foreign Offices are getting increasingly involved in climate change matters. Almost all countries have created a climate change-related office dependent on some public organism which participates in international negotiations. In this sense, it must be highlighted that Latin American countries negotiate within the so-called `G-77´ group. These countries joined together in order to confront developed countries´ pressures in several areas (not only climate change) but they have not been able to build neither a regional own identity nor a common space for fostering reflection and information exchange. Dialogue fora are usually irregular and, in relation to climate change, they tend to focus on specific issues (for example, REDD[11]). Besides, the lack of human and financial resources have limited the possibilities of attending an agenda that is becoming increasingly complex with regards both to the issues at stake and the discussion spaces. As a result, only few specialized civil servants are able to assist to international conferences. In addition, Mexico and Brasil (the two strongest countries in the region both from an economic and geopolitical point of view) are gaining increasing importance in the developed world and they are currently part of the so-called `G-5´ group, together with China, India and South Africa. This group is increasingly considering the possibility of developing

[11] Reducing Emissions from Deforestation and Forest Degradation.

countries´ assuming some kind of quantitative mitigation commitments in the post-Kyoto period (Samaniego, 2009).

Finally, the constitutional level of action refers to those decisions governed by constitutional rules. Here, the climate-related `constitutions´ that are currently in force at international level (and, therefore, that determine national decisions) are the UNFCCC and the Kyoto Protocol. These treaties currently constitute the legal framework within which all countries of the world (including Latin American ones) are negotiating their efforts to reduce emmissions and adapt to climate change. As it was already mentioned, in the UNFCCC Conference held in Durban in December 2011 (COP 17) it was agreed that a second commitment period (after 2012) will be adopted. Although decisions regarding both its extension and the specific mitigation goals for each county are still awaited, it is clear that Kyoto´s architecture, with its normative framework, its modalities, mechanisms and procedures, will still be an important constituitive part of the system.

After analyzing the functional and structural tiers of institutions, the next analytical step, following Paavola (2006), involves identifying governance functions, which mainly include: exclusion of unauthorized users; regulation of authorized resource uses and distribution of their benefits; provisioning and recovery of costs; monitoring; enforcement; conflict resolution and collective choice. With regards to climate change, all these functions are mainly carried out currently at the constitutional level, ie. by United Nations international organizations´ frameworks. However, at the collective level national governments are increasingly getting involved in the design and implementation of formal climate change national policies. In this regard, it can be seen an incipient division of labour between government organisms and agencies and different organization of functions at different levels. Finally, with regards to the operational level, individuals do not participate directly in decision-making processes related to climate change.

Something similar happens in relation to the institutional rules, namely rules of exclusion, entitlement rules, monitoring rules and decision-making rules. They are mainly decided at the constitutional (international) level and, to a lesser extent, in the collective (national) level.

Needless to say, this governance configuration has particular transaction costs and distributive justice implications. Transaction costs mainly involve the (usually high)

costs of seeking information, conducting negotiations, formulating rules, monitoring and enforcing compliance, both at the international and national levels. With regards to distributive justice, it is worth pointing out that this governance arrangement exacerbates historical geopolitical North-South disparities and, at the national level, it attempts on poor scarcely-represented communities and regions, with low political voice and high vulnerability to climate change.

This analytical scheme is represented in Figure 2 below, where the main conditioning factors in each area are highlighted.

Figure 2: NIE-based analytical framework for stylizing climate change and development challenges in Latin America

Nature and scale of governance problem:
long-term global problem with environmental, socioeconomic, distributive, political, equity and development implications

Interdependences to take into account when designing climate change governance arrangements in Latin America	Functional and structural tiers of institutions: multi-level structure	Organization of governance functions	Key institutional rules
Economic Strong economic dependence on natural resources (GDP, exports) Natural resources are key elements for food and energy security Cheap mitigation options Adaptation needs No mitigation commitments (yet) Financing Competitiveness	**Operational level** (individual choices) Latin American citizens not much politically involved in climate change issues Not much consciousness regarding natural resources protection	Individuals do not participate directly in decision-making processes related to climate change	
	Collective level Environment Ministries and Foreign Offices increasingly involved in climate change matters Weak Latin American presence in international fora	Incipient involvement of national governments	
Equity Historical responsibility of developed countries Less developed countries more threatened by climate change impacts than developed ones Developed countries reluctant to finance mitigation and adaptation measures in less developed ones	**Constitutional level** UNFCCC Kyoto Protocol	Exclusion Regulation of use Provisioning Cost recovery Monitoring Enforcement Conflict resolution	Exclusion Entitlement Monitoring Decision-making
Effectiveness Need of coordinated action			

Transaction costs

Source: Own Elaboration based on Paavola (2006)

Social justice implications

In summary, a NIE-based analytical approach can make the following contributions to the design process of climate change institutions in Latin America from an economic perspective:

- It helps clarify the different categories of institutions, functions and rules involved in governance arrangements, highlighting that different actions are more efficiently performed at different levels (global, regional, national or local).

- It makes the analyst think in terms of `interdependence´ rather than of `externality´, therefore reinforcing the idea that agents´ choices influence reciprocally the options available for others.

- The identification of interdependences and of their scope helps identify in advance potential sources of conflict that are usually not considered in traditional economic approaches based on mathematical tools.

- The concept of interdependence shows that international pressures regarding access to natural resources are directly or indirectly related to greatest geopolitical interests, especially in a global crisis context. Therefore, governance design in the region should guarantee local access to resources and decision power regarding the use of resources and conceptualize their protection as a fundamental priority within political and national security agendas.

- The interdependence concept also helps understand that within each Latin American country there are serious problems for defining and regulating natural resource use. Local population is highly interdependent in this regard and climate change exacerbates the original vulnerability of communities and geographical areas.

- This approach also makes the analyst think about the internal institutional limitations for implementing sustainable development policies in general, therefore helping weight up the scope of the climate change challenge: if the region cannot solve her own domestic problems regarding natural resources exploitation, how can she contribute to solving the global ones? This is the key challenge behind designing climate change governance structures in Latin America: institutions need to tackle the international pressures regarding GHG mitigation and world energy

and food security but at the same time they have to foster a local move to a more sustainable development path.

- The NIE approach introduces explicitely the equity dimmension in the analysis, making the analyst think of the distributive consequences of the arrangements that are being proposed. It also makes him think of the motivations and values that guide his choices. This approach turns efficiency dilemmas into moral ones and makes full rationality a doubtful assumption.

6. Conclusions

Climate change is a long-term global environmental problem with serious socioeconomic, political and equity implications. It severely threatens development possibilities in developing countries and it poses serious concerns regarding world energy and food security. It is also placing global natural resource providers in a strategic international position, therefore intensifying geopolitical tensions and increasing rivalry with regards to access to new regions and resources.

With regards specifically to Latin America - the case study developed in this paper - the region constitutes a key world reserve of natural resources with strategic importance for both the regional and global economy. At the national level, not only is the domestic productive activity mainly based on natural resource exploitation and export but also many local communities depend entirely on these resources for survival. This means that access to resources is a key issue in the region. Within the international context, those areas with important energetic resources reserves such as oil, gas and coal, mining and water resources and biodiversity reserves are becoming increasingly globally strategic and, in consequence, increasingly conflictive.

Economics has approached the climate challenge the same way it has traditionally tackled all environmental problems: treating it as an efficiency dilemma where rational agents try to find their optimal path maximizing their selfish well-being. From a public policy perspective, Economics has focused on finding optimal instruments that could be applied in any circumstances, regardless of the institutional context and the underlying governance mechanisms that inevitably condition their implementation and political acceptance. This approach has involved optimization, cost-benefit analysis and game

theory exercises as the analtical tools that have guided decision making and policy design so far.

This traditional theoretical approach has provided interesting and useful insights and has contributed positively to a more profound comprehension of the problem. However, it is argued that climate change poses many simultaneous institutional and policy challenges, uncertainties (mainly regarding expected impacts and associated costs) and intra and inter-generational equity dilemmas that go beyond efficiency considerations. For these reasons, a more comprehensive analytical approach is needed in order to consider climate change socioeconomic and development implications especially in developing countries.

In this context, this paper argued that an approach from New Institutional Economics can shed some light by complementing and even going beyond traditional economic analysis. The NIE is an interdisciplinary school of thought that encompasses findings from Economics, Political Science, Sociology and Anthropology and that departures from traditional Economics in two main points. Firstly, the NIE bases the analysis of environmental problems on the notion of `interdependence´ rather than on the idea of `externality´. This means considering mutual influences, effects and limitations in any bilateral relationship and not only one-way damages imposed by one party to the other without the consent of the affected one. Secondly, the NIE acknowledges that transaction costs exist, which means recognizing that the implementation of policies inevitably involves costs that influence economic outcomes. The NIE also takes explicitely into account the distributive implications of choosing among different institutional arrangements.

The analysis of interdependences among agents and in relation to natural resources is key when tackling the climate change problem mainly because climate change poses serious dilemmas regarding priorities: on the one hand, adaptation priorities (which regions and/or communities will be attended first) and on the other, mitigation priorities (which emission reduction strategies will be chosen, taking into account that this selection is not neutral regarding efforts and costs). Therefore, there is a necessity of balancing competing needs and of defining whose interests are to prevail and to what degree. This means that climate change poses equity dilemmas that cannot be properly solved by mathematical analysis and behavioral assumptions of full rationality. Equity dilemmas involve considerations and decisions that belong to the moral and emotional dimmensions of human beings´ psychism, which means that decision

making in this regard will be inevitably based on subjective considerations that will vary from one individual to the other.

In this context, the only way an economic theoretical approach can help is by providing a stylized framework where all the variables at stake and the ralationships among them can be clearly seen, not only the economic and efficiency ones but also the political, international, historical and equity variables. This framework can help identify the main elements that must be inevitably taken into account when designing governance arrangements for tackling climate change in specific contexts. However, this framework will not be able to provide an `optimal´ solution, simply because there are hardly any `optimal´ solutions with regards to equity dilemmas: it all depends on the values and motivations of the involved agents.

In other words, there are not unique and `true´ answers for the climate change problem because many of its implications involve value judgements. Beyond each position in the climate change international debate there is a different conception of how to distribute responsibilities and costs among the countries of the world and between the present and future generations. This is why it is so hard to achieve that all countries, each of them with different realities, histories and future perspectives, can agree on a unique international arrangement. The key to achieve global acceptance of any agreement lies in guaranteeing a fair treatment to all parties. The problem is, precisely, what each party considers as `fair´.

In such a context, and facing the limitations exposed above, the NIE can make the following contributions to an economic analysis of climate change.

Firstly, the analytical approach of the NIE based on identifying categories of institutions, rules and functions can provide some sort of `road map´ for thinking about suitable climate institutions for country-specific contexts, highlighting the fact that some actions will be more efficiently performed at the global level but some others at the regional, national or subnational levels.

Secondly, this appoach helps identify local institutional limitations that may hinder the implementation of climate governance arrangements. Revising the local performance of agents, organizations, behaviors and interrelationships regarding development and natural resource management highlights the unsolved domestic problems, therefore providing a scale for weighing the dimmension of the climate change challenge: climate

change will aggravate development problems already facing the region; in this sense, the deeper the development problems, the bigger the climate change challenge.

Thirdly, the NIE apprach helps foresee potential conflict regarding rivalry on access to natural resources, which can be tackled in advance at the time of the design of governance arrangements. This may save time and financial resources because if conflict is not approached *a priori* it inevitably will have to be addressed *ex post* in court or in other social arenas.

Finally, the NIE approach introduces explicitely the idea that governance arrangements are not neutral regarding transaction costs and distributive justice implications and that the equity dimmension is a key aspect of the analysis. This goes beyond the traditional economic conceptualization of climate change as just an efficiency dilemma, highlighting the moral component of any policy decision.

With regards specifically to climate change analysis in Latin America, the NIE analytical framework can help identify the key issues that determine the regional reality with regards to natural resources and development paths and that should not be overlooked when designing local climate governance arrangements:

i) Latin American countries are economically and socially dependent on natural resources and agents within the region are highly interdependent regarding access to them.

ii) Natural resources have not been historically managed in a sustainable way and regional development paths have been based on this irrational exploitation.

iii) The current international global crisis context and the future alarming perspectives regarding energy and food security locate the region in a strategic international place as a global resource provider but, at the same time, pose several pressures regarding external access to domestic natural resources.

iv) Climate change will aggravate development problems in the region. Therefore, local climate institutions should prioritize fostering development even at the expense of complying with international pressures regarding mitigation.

v) However, the region should make efforts aimed at decarbonizing economic activities and moving to a more sustainable low-carbon trajectory. This means deeply redefining the local relationship with natural resources.

vi) Local access to natural resources should be guaranteed by stating their protection as a fundamental priority within national security agendas.

In summary, economic approaches to the climate change problem so far have not considered governance issues as a key aspect of policy design, therefore assuming that any optimal instrument can be implemented in any circumstances. However, institutional arrangements and mechanisms may hinder the implementation of policies even if they are considered ideal from an efficiency perspective. This is especially acute in developing countries, where institutional limitations (especially with regards to economic and social development and natural resources protection) are usually severe. In this context, New Institutional Economics may contribute to a more comprehensive analysis of the climate change problem by providing an analytical framework based on the concept of `interdependence´, positive transaction costs, a categorization of institutions, functions and rules and a focus on the equity consequences of governance arrangements. This framework has so far proven useful for analyzing Latin America´s challenges regarding climate change.

Economics should take carefully into account the fact that there are critical equity and institutional issues at stake beyond the economic dimmension of the climate change problem. From a conceptual point of view, this means internalizing that there is not only an efficiency challenge but also, and fundamentally, a social justice dilemma. Profoundly understanding the historical, environmental and geopolitical matters that lay behind the climate change conflicting international negotiations will be the only way of finding how to make compatible economic growth, social development, natural resource protection and private benefit maximization.

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