

THE STRUCTURE OF CLIMATE CHANGE AGREEMENTS AND THE NATIONAL BENEFITS OF TACKLING CLIMATE CHANGE ¹

The incentives of nation states to participate in international agreements to reduce greenhouse gas emissions depend on the structure of the proposed agreements. Emissions trading may make the collective action problem of climate change *worse* because it produces a perverse incentive to commit to less in the original negotiations, due to the value of emissions permits to nation states.

The Kyoto protocol (and possibly the upcoming Copenhagen treaty) impose national targets for future greenhouse gas emissions coupled with emissions trading. Emissions trading, however, implies that the right to emit has tradeable value, which alters the incentives to commit to reductions in the original negotiations. The value of permits therefore provides an incentive for individual nation-states to commit to less stringent targets; because they will wish to grant themselves more permits. These problems are potentially made worse if some parts of the world are allowed to participate without a cap. This result is extended to the notion of a positive global *institution*, as a set of rules which changes agents' incentives to participate and make it more likely that a cooperative outcome is attained. Coordinated taxes with a voting system are a global institution in a sense that quantitative targets with international emissions trading are not. We consider the national costs and benefits of tackling climate change. Finally we develop an additional conservative design criteria for policy formulation – treaty structures should minimize the transfer of rents relative to the *status quo ex ante* – *incentive* effects can be separated from *income* and *endowment* effects.

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Introduction

Discussions of climate change policy often assume that there is a 'collective action problem' (see e.g. Talbott)² associated with a global public good such as the atmosphere, often referred to as a 'tragedy of the commons' (Hardin 1968; Grasso 2004). This paper analyses such a problem and argues in fact that there may be two, closely related, but separate, problems.

- Firstly there may be a collective action problem³ associated with the costs of greenhouse gas abatement to individual nations.
- Secondly, there may be a collective action problem⁴ associated with the structure of the institutions we use for solving the problem.

Often it is assumed that the two problems are the same; the 'burden' is the reduction in emissions and we might allocate this in various ways by 'burden sharing'.

It may be that the macroeconomic costs of optimal real policy changes to reduce greenhouse gas emissions are positive at the margin, but that the structure of proposed international agreements is such that, at the margin the overwhelming incentive is to negotiate for more permits and therefore fewer emissions reductions.

Why Analyse at the National Level?

National interest is argued to be an appropriate concept for understanding the climate change negotiation game. Nation-states are the key actors involved in taking policy positions to reduce emissions. Most decisions are taken at the national level. The decision over how to set up a tax system; the decision over whether to participate in international agreements; all these decisions are taken at the national level. The primacy of national sovereignty is emphasized (with a few exceptions such as the European Union) in international law; from the treaty of Westphalia to the United Nations founding charter.⁵

That is not to say that the national interest is a straightforward thing to define. Different parts of the world will have different perceived interests, according to their state of development. In this document, I will simplify by considering each state to be an actor which maximises its' long term wealth. A country will act in its own interest.

2 (Talbott): A **Collective Action Problem** is defined as “A situation in which everyone (in a given group) has a choice between two alternatives and where, if everyone involved chooses the alternative act that is **Individualistically Rational** (IR), the outcome will be worse for everyone involved, in their own estimation, than it would be if they were all to choose the other alternative (i.e., than it would be if they were all to choose the alternative that is not IR).”;

For an agent to behave **Individualistically Rationally** (IR) is “To Maximize One's Expected Return (Total Expected Benefits Less Total Expected Costs). This sense of rationality is the twentieth-century development of the concept of Instrumental Rationality. It is the notion of rationality that is employed in economics. (Note that to be Individualistically Rational does not require that one be an egoist.)”

- 3 Or a “natural tragedy” - i.e. a collective action problem that is unavoidable; assuming that the structure of agents and coercive agents is fixed but the structure of policy is not.
- 4 Or an “unnatural tragedy” - a collective action problem which is purely an artefact of the structure of the institutions used to solve the problem.
- 5 On the other hand, it is not clear that modern states are especially simple. The following alternative aspects could be outlined
 - Nation State -- National-Hobbesian (Hobbesian National Interest)
 - Voters -- Democratic (Democratic/Public Choice Theory)
 - Companies -- Interest group theory (Marxist Theory)
 - Institutional Interests - Church
 - Speaking rational community (Aristotle: representative element, integrative element)

Why Game Theory?

In this paper, I will analyse the incentives of international agents according to *game theory*.

Game theory describes the behaviour of agents under two conditions:

- a) the behaviour of agents is completely described by some pay-off function which the agents are expected to strictly target
- b) the pay-off of an agent is not only determined by that agent's own choices, but also the choices of other agents.

A collective action problem is a situation where the incentives of individual actors differ from the average interests of all. It is argued that there is such a collective action problem with regard to international agreements to reduce greenhouse gas emissions. There is an incentive to free-ride on the actions of others in regard to international action. One nation can desist from reducing its emissions while others do so. If everyone does this the net result is that few or no reductions take place.

A Game Theoretic Model of Emissions Trading and Harmonized Taxes

In this section we set out the incentives for a country to engage in various emissions reduction treaties. The pay-off for a country for emissions trading and for harmonized taxes are outlined.

Emissions Trading

Country: i

Permits to emit: R_i

Emissions: E_i

Price of permits $P(R_i, E_i)$

Net international payments: $R_i - E_i P$

Cost of emissions target: $C(E_i)$

Climate Damage: $D_i = D(\sum E_i)/n$

Net Benefit: $C(E_i) - D(\sum E_i)/n + R_i - E_i P$

1: Negotiation Stage: Choose R_i

2: Implementation: Choose E_i

Harmonized Taxes

Country: i

Tax Rate: T

Emissions: $E_i(T)$

International payments: 0

Cost of emissions target: $C(E_i)$

Climate Damage $D_i = D(E(T))/n$

National Benefit: $C(E/n) - D(E(T))/n$

1: Negotiation Stage: Choose R_i

2: Implementation: Choose E_i

Sharing of a variable-sized pie

Unfortunately, direct or indirect discussion of quotas actually distracts from the problem itself and instead focuses attentions on the size of each participant's slice of the pie. Each wants a larger slice, and the net result is that the pie itself gets bigger, a disastrous outcome for the planet as a whole.

Is there a natural tragedy? Evidence for Positive Benefits from Climate Policy

Some economic evidence suggests that a stable carbon tax might encourage economic growth rather than the reverse. A carbon tax is essentially a consumption tax, which has many positive economic benefits related to promoting economic growth. So quantitative reductions may have and be seen to have negative value for each nation and yet a policy to achieve the same goal (among other things) may have a positive value.

Towards a New Criterion

Climate change agreements are often analysed according to three criteria: effectiveness, efficiency, and equity. When applied to climate change, widely understood to be caused by the industrialized north and largely affecting the poor south, it could be argued that in regard to equity, the importance of a high level of political feasibility and environmental effectiveness trumps the direct short term financial implications of climate change policy.

Here, I argue for a new way of thinking about equity and political feasibility: a climate change policy should be as near as possible a *neutral* change in the *interests* of agents. It is possible to separate the *interests* of agents in participating in an agreement from the marginal *incentives* of agents to change their behaviour once within an agreement, by appropriate lump sum payments.

Is there any way that emissions trading could work?

The simplest solution to the dilemma is to replace emissions trading with coordinated taxes. Another solution is a multi-stage negotiation process, where a *framework* for deciding upon the allocation of permits is considered.

1. Enforcement
2. Framework for the Allocation of Permits
3. Global Target

In this way, the global incentives of harmonized taxes are replicated, ensuring that 'permit seeking' does not make the agreement useless.

National Costs and Benefits Of Mitigation Climate Change

What are the national macroeconomic benefits and costs of tackling climate change?

The macroeconomic benefits and costs of climate change are the changes in (global or national) income as a result of climate change policy. Macroeconomic costs measure the overall change in the economy. Here we focus on the national level (changes in National Income). Estimates of changes in global product are available in the literature (Stern 2006).

Macroeconomic costs is a larger concept, to be distinguished from the *investment* required to tackle climate change (how much money has to be invested now), or the *energy system cost* of so doing (the net change in expenditures for the whole energy system). Macroeconomic cost includes the changes in income (GDP) for the whole economy.⁶

What do macroeconomic costs depend upon?

Climate Change policy usually involves a **price of carbon**: such as carbon taxation or emissions trading. These carbon pricing schemes collect **revenue** for the government which levies the tax, revenues which can be spent to reduce other taxes.⁷

The Economic Benefits from Climate Policy

Capture of Fossil Fuel Scarcity Rent (otherwise taken by cartel members/owners of resource) & Long-term **Security of Supply** (when fossil fuels are imported).

Displacement of Taxation with higher deadweight costs and thus increased economic output, **Environmental Co-benefits** (e.g. low greenhouse gas technologies also have low levels of other pollution, electric cars produce lower levels of *noise*). (Although wind turbines are noisy).

Conservation of indigenous resources which may have alternative or future uses (when fossil fuels are indigenously produced).

Learning by Doing. Arrow (1962) points out that a quantitative understanding of the major factors in economic growth leads to the conclusion that technological change is of fundamental quantitative importance. While technological learning is usually a global phenomenon, for less mature technologies (e.g. wave power) learning may provide a significant local benefit.

Climate Benefits. For a large country such as China, the direct climate benefits of Chinese action on China itself may be significant. Even smaller countries might have a global influence if they can 'show the way'.

6 Measures of income such (GDP) can be criticised because they do not distinguish between productive and unproductive use of resources. Some have suggested (e.g. Dasgupta 2001) that, rather than GDP change, we should actually look at changes in *wealth* (including natural wealth). By this criterion, climate change policy will also cause an increase in wealth, since replacements for fossil fuels tend to require **physical assets**. **Financial wealth** will of course depend on **financial assets**, but these are likely to be increased too, depending on the response of other parts of the economy.

7 The revenue from either a tax or permit scheme could be used for other purposes of course, such as bribing the incumbents to accept the scheme, often known as 'grandfathering' of permits.

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