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The European Union's Emission Trading Scheme: Political Economy and Bureaucratic Rent-Seeking

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THE EUROPEAN UNION'S EMISSIONS TRADING SCHEME: POLITICAL ECONOMY AND BUREAUCRATIC RENT-SEEKING

Graham Mallard

Working Paper (May 2009)

A political economy model is presented that proposes an effective explanation as to why national allocation plans in the emissions trading scheme of the European Union have taken the form they have. The influence of the national bureaucracy, which is omitted in the majority of the related political economy literature, is shown to be potentially significant and costly – particularly through its interaction with the influence of the affected industrialists. The analysis suggests that the role of the national bureaucracy in the design of environmental policy should be carefully considered and structured, and suggests an avenue of potentially important and fruitful future research.

Key words: *Lobbying; political economy; environmental policy; common agency models; bureaucracy; emissions trading*

1. INTRODUCTION

The emissions trading scheme of the European Union (EU), here-forth referred to simply as the Scheme, was launched in January 2005 and is now the most extensive cap-and-trade[1] scheme in the world. Now in its second phase (2008-12), it comprises installations from the highest carbon dioxide (CO_2) emitting activities[2] in the EU: together accounting for approximately 45 per cent of the EU's CO_2 emissions (Egenhofer, 2007). A number of European Union Allowances, each permitting the holder to emit one tonne of carbon, are annually allocated to the installations to be used to cover current or future emissions, or to trade with others in the Scheme.

The allocation of allowances is largely left to the discretion of EU member states. Prior to each phase of the Scheme, and based on European Commission advice (EC, 2003) and guidelines (EU, 2003 and EC, 2004), each member state is required to submit a national allocation plan to the Commission outlining its allocation. The Commission acts as verifier of these plans, possessing the power to insist on changes when necessary.

It is widely acknowledged that environmental policy design can be explained by the interaction of interest group influences; and the tools of modern political economy have been employed to do precisely this (see, for example, Yu 2005). However, although the environmental and economic consequences of the Scheme's allocation plans in both Phases One and Two have been subject to considerable analysis (see, amongst others, Åhman and Holmgren 2006; Betz and

[1] A cap-and-trade scheme is one in which the authority determines total output (the cap) and the participants subsequently determine the distribution through trade. In this case the output is carbon emissions.

[2] The activities included in the second phase of the scheme are those producing: (i) energy; (ii) non-ferrous metals; (iii) pulp and paper; (iv) lime; (v) cement; and (vi) chemicals.

Sato 2006; Kemfert *et al.* 2006; Neuhoff *et al.* 2006a; Neuhoff *et al.* 2006b; Sijm *et al.* 2006; Smale *et al.* 2006; and Kettner *et al.* 2007), there is little in the literature by way of analysis of why the plans have taken the form they have. In addition, the large majority of the existing political economy analysis focuses on the roles of only three of the key players (using game theoretic terminology): the government, participants and environmental groups; thereby omitting the influence of the national bureaucracy. Svendson (2003) is a notable exception to this. This is an important omission from, and weakness of, existing analyses because national bureaucracies often have two, potentially significant, effects on policy design: (i) as a conduit through which other players indirectly lobby the government; and (ii) as an affected interest group in its own right – being the body that actually implements policies.

The intention of the present paper is to address these two weaknesses in the literature. Firstly, to analyse why allocation plans in the Scheme have been designed the way they have; and secondly, to incorporate the important role of the national bureaucracy into such analysis. Regarding the first of these, particular attention is given to the following aspects of plan design: (i) the division of the necessary abatement burden (necessary in terms of satisfying pre-existing burden-sharing agreement commitments[3]) between the trading sector (composed of the activities) in the Scheme and the rest of the economy; and (ii) the extent to which allowance allocation is differentiated according to the different characteristics of the activities in the trading sector. The next section reviews the actual process employed by member states to design allocation plans, along with the key characteristics of the final designs, which are then used to inform and evaluate subsequent analysis. Sections 3 through 5 present a common agency model specifically constructed for this particular analysis that is then used, along with marginal analysis, to address the two intentions of this paper. Sections 6 and 7 present a discussion of the results and suggestions for further research.

2. DESIGNING ALLOCATION PLANS IN REALITY

> "The *elaboration of the [national allocation plan] is a political process, whose outcome may not be 'rational' from an economist's perspective, but the result of the interaction between several actors and the balancing of conflicting interactive variables and criteria*" (del Río 2007: 209)

In designing allocation plans for Phase One of the Scheme, most member states delegated the generation of design recommendations to different departments within their national bureaucracies at, broadly speaking, three levels of responsibility. Environmental departments usually took the lead; with the departments for the economy and for taxation accepting a supporting position; and

[3] When signing the international agreement to reduce greenhouse gas emissions developed at Kyoto, the EU-15 (as they then were) collectively agreed to reduce emissions by eight per cent by 2008-12 relative to 1990 levels. This abatement burden was shared across the fifteen states in the burden-sharing agreement. The UK, for instance, committed itself to reducing emissions by 12.5 per cent from 1990 levels by 2008/12; whereas Luxembourg accepted the greatest relative burden (28 per cent) and Portugal the least (it could expand emissions by 27 per cent).

with representatives from other interested departments adopting peripheral roles (see Table 1 for details from three member states). Lead departments usually organised inter-departmental groups to coordinate the design process, and often commissioned external consultants to provide advice: for example, the Klein Institute in the case of Spain. Non-public working groups were organised to survey the views within the trading sector (Zapfel, 2007), but usually environmental groups were excluded from these meetings. In the UK there were four major consultations during the design period (Harrison and Radov, 2007), covering aspects such as general allowance allocation methodology, sector growth rates, and the new entrants' reserve [4]. The resulting design recommendations were then presented to governments, which ultimately made the final decisions regarding the allocation plan to be submitted to the Commission for review following their own stakeholder consultation period (a requirement of Annex III of the Directive: EC 2003).

Level of Responsibility	UK	Denmark	Spain*
Lead	Department for Environment, Food and Rural Affairs; and the Environment Agency	Ministries of the Environment (specifically the Environment Protection Agency), and of Transport and Energy (specifically the Danish Energy Authority)	Ministry of the Environment (specifically the Spanish Climate Change Office)
Supporting	Department of Trade and Industry	Ministries of Finance and Taxation	Ministry of Economics
Peripheral	Other interested departments	Other interested departments	Other interested departments
Source	Harrison and Radov (2007)	Pederson (2007)	del Río (2007)

Table 1: Allocation plan design responsibilities in the UK, Denmark and Spain

* *The responsibilities for the Spanish recommendations changed due to lobbying and change of government. The reported responsibilities are those in existence upon submission of the Spanish allocation plan.*

Lobbying, both direct and indirect (Yu, 2005), was important throughout the design process. Representatives from the trading sectors (usually in the form of sector associations) were concerned that the abatement burden imposed on them should not be excessive: particularly when compared to those in other member states. Many trading sector representatives challenged the proposed allocations to their activities based on the projected sector growth rates employed and the calculation of contributions to the new entrants' reserves. Many also argued that there should be greater differentiation of allowance allocation so that specific characteristics of activities would be taken into greater consideration.

In Spain, the trading sector adopted two clear approaches to lobbying. It lobbied the government directly; but also engaged in indirect lobbying: publishing complaints in the general press as well as in economic journals. Spain is also a good example of how this lobbying was not always straightforward. Take the Spanish electricity sector, for instance. It comprises three main producers, together accounting for some 90 per cent of the domestic electricity market: (i) Iberdrola:

[4] The new entrants' reserve is a bank of allowances set aside for any new installations that are subsequently required to be in the Scheme. The extent and conditions of the reserves vary considerably across member states.

the cleanest producer of energy due to its investment in renewables; (ii) Unión Fenosa: which has the greatest greenhouse gas emissions per kilowatt-hour; and (iii) Endesa: which lies in between the other two regarding carbon emissions. Iberdrola advocated a high abatement burden to be placed on the trading sector (advocating the allocation of the equivalent of 70 Mt CO_2 of allowances to the sector), whereas the other two inevitably advocated a more lenient abatement burden: 96 MT CO_2 (del Río, 2007).

The UK is perhaps the clearest example of the effects of lobbying during the government's consultation period. The draft plan proposed the inclusion of 867 installations divided into 14 activity sub-divisions. The final plan submitted to the Commission included 1054 installations in 52 sub-divisions. Further complexity was added due to the influence of lobbying for greater differentiation in the allocation of allowances. Three rules (the baseline, commissioning and rationalisation rules), adjusting the base periods to be used for allowance allocation, were added to offset any competitive disadvantage caused by the original formula (Harrison and Radov, 2007). Similar can also be said of Spain. The consultants recommended an allocation of 22.148 million allowances each year, but at least partly due to trading sector lobbying, the final allocation chosen by the government amounted to 22.5 million (del Río, 2007).

When considering these influences, it should be stressed that the ultimate result of the design processes in the separate member states was the achievement of a functioning emissions trading scheme: a feat that Grubb and Neuhoff (2006) suggest is remarkable considering the historical success of pan-European environmental policy implementation. However, this achievement came at a cost: a divergence from the economically efficient design – which in this case should be defined as the minimisation of total abatement and administration costs given a level of imposed abatement. The Scheme is significantly more complicated, and comprises many more administrative rules (Zapfel, 2007), than economists had intended: particularly the hyper-differentiation of activities to ensure that specific industrial circumstances are considered (Ellerman et al., 2007). The Scheme has also tended to impose a much more lenient abatement burden on the trading sector than is economically efficient. Figure 1 compares the abatement burdens, in terms of the percentage reduction in CO_2 emissions (relative to 1990 levels) required of the trading sectors, imposed in the plans for Phase Two of a selection of member states with those that would be proportional to the national Kyoto commitments. [5] A position above the line of proportionality implies that the trading sector is bearing a relatively large abatement burden compared to that required of the whole economy; whereas a position beneath it implies that the emissions of the trading sector are being subsidised by other sectors in the economy. As Figure 1 clearly illustrates, for a sample of member states that can be considered representative of the EU-25, most member states treated their trading sectors leniently. Böhringer *et al.* (2005 and 2006) and Peterson (2006) argue that an abatement burden for the trading sector that is less than proportional to the national

[5] The selection was enforced by data limitations. Only those member states that had published the summary tables of their Phase Two allocation plans on Eurostat are included. Those member states that have a negative national abatement burden (Greece and Slovakia) have an emissions target relative to that necessary for it to achieve its Kyoto agreements that allows it to actually increase emissions.

abatement burden is economically inefficient as the trading sector is likely to have a lower marginal cost of abatement than the non-trading sector.

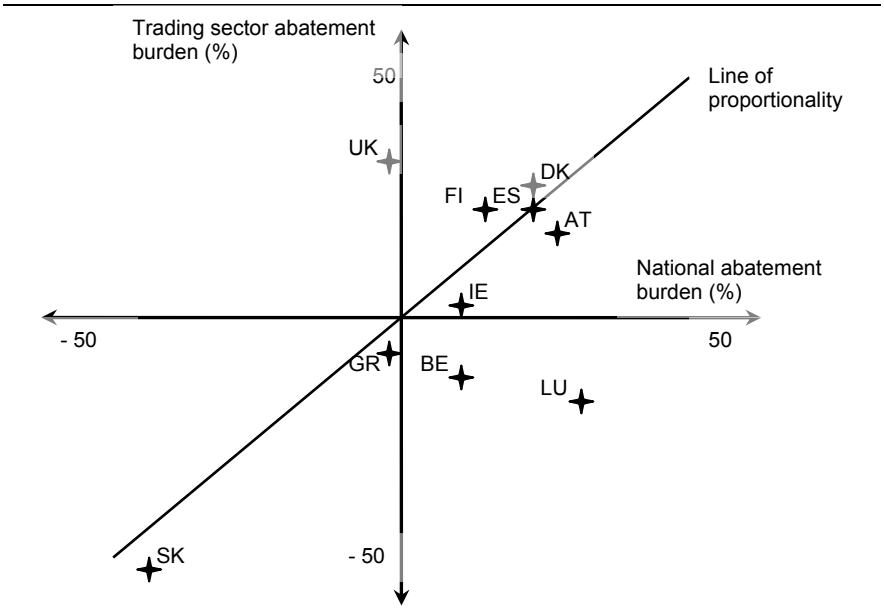


Figure 1: The extent of the trading sector abatement burden in Phase Two relative to national Kyoto commitments (Data source: Eurostat)[6]

Overall, then, there are two salient characteristics of the allocation plans that have been actually implemented: (i) they are more sophisticated, and so have a greater degree of differentiation in the allocation of allowances, than expected; and (ii) they tend to impose an abatement burden on the trading sector that is more lenient than economists had hoped for. These are the two design characteristics that this paper presents an explanation for.

3. THE STRUCTURE OF THE GAME

The model takes the form of a common agency model as developed by Grossman and Helpman (1994) from the work of Bernheim and Whinston (1986), that is most closely associated with that presented by Yu (2005).

Allocation plan design is modelled as a three-stage process involving five players (Figure 2): a structure firmly based on the description of reality in Section 2. For parsimony it is assumed that the responsibility for the generation of design recommendations is delegated to a single bureaucratic department.

It should be noted that the public, predominantly transport users/providers and households, are not modelled as organising an effective lobbying group (even through non-governmental

[6] The position of the UK, although surprising, is due to it already having achieved its Kyoto target prior to the start of Phase Two and so was actually able to increase its emissions during that Phase.

organisations) because they are too numerous: the net marginal benefit to an individual joining the lobbying effort is not a sufficient incentive to do so[7].

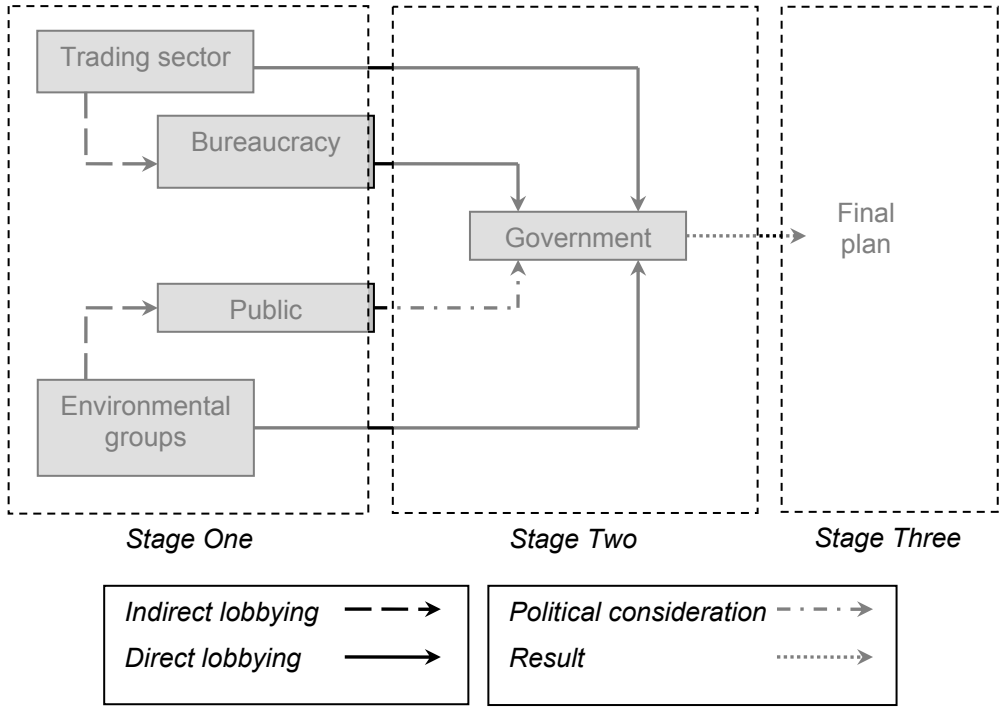


Figure 2: Model structure

In stage one, the bureaucracy engages in talks with trading sector representatives in the process of generating design recommendations for the government. The latter compete with one another for a favourable plan design largely by providing the bureaucracy with sector growth rates and emissions projections. During this stage, environmental groups indirectly lobby the public to obtain support for more ambitious environmental targets – i.e. for a greater abatement burden to be imposed on the trading sector. It should be noted that, in general accordance with the actual design processes implemented by the EU member states (see Section 2), environmental groups cannot influence the recommendations to be made by the bureaucracy as they were usually not invited to the working-group tables. In stage two, the bureaucracy reports its recommendations to the government and then, along with the trading sector as a whole and the environmental groups, lobbies the government to influence the final design.

The bureaucracy, which is usually omitted from political economy analysis of environmental policy, has its own interest in the design of the plan. Ultimately, it is the body that will implement and monitor the Scheme and so rationally wants to secure its future responsibility (and with it the job-security and status of its workforce) for the Scheme by increasing the administration workload it requires (this is based on the assertions of Svendsen, 2003). In practice, this means increasing the

[7] This follows the standard argument as to why it is not rational for a given individual to vote in national elections, but in this case the rationality is not overcome by cultural factors such as the perceived importance of voting (see Olson, 1965).

degree to which allowance allocation is differentiated as greater differentiation necessitates greater analysis and processing. However, this motivation is gradually ameliorated by the fear of being unable to cope with too much complexity. If W_B is the gross welfare of the bureaucracy before the expenditure on lobbying has been deducted; d is the degree of differentiation in the plan; and d^B is the degree of differentiation that the bureaucracy wants established: $W_B = W_B(\left|d^B - d\right|)$, with $W_B^{'}(\left|d^B - d\right|) > 0$ and $W_B^{''}(\left|d^B - d\right|) < 0$. The welfare function of the bureaucracy is structured in terms of the absolute divergence of d from d^B because any divergence, in either direction, serves to reduce its welfare.

The trading sector rationally seeks two characteristics for the plan: (i) the overall minimisation of the abatement burden that it bears in order to minimise the competitive disadvantage caused; and (ii) the maximisation of the degree to which the allowance allocation is differentiated so that individual industrial characteristics are accounted for. If W_T is the gross welfare of the trading sector before the deduction of lobbying expenses; b is the abatement burden imposed; and d is again the degree of differentiation, then: $W_T = W_T(b,d)$, with $W_T^{'}(b) < 0$, $W_T^{''}(b) > 0$, $W_T^{'}(d) > 0$ and $W_T^{''}(d) < 0$.

The environmental groups are assumed to simply want the maximisation of the abatement burden imposed on the trading sector, so that environmental benefits are maximised. Using similar notation to that above: $W_E = W_E(b)$, with $W_E^{'}(b) > 0$ and $W_E^{''}(b) < 0$.

The public, which only influences the final design of the plan through governmental consideration of the potential political damage the plan causes, is concerned that: (i) the abatement burden imposed on the trading sector be balanced; and (ii) the degree to which allowance allocation is differentiated within the plan be restrained. The justification of the second of these concerns is the more straightforward of the two – greater differentiation can be assumed to necessitate greater expenditure from the public coffers and so inevitably means a greater financial burden being imposed on the public. The first of these concerns is more complicated as it is composed of two conflicting pressures. The public is assumed to be aware that the government has, as part of the Kyoto Protocol at the very least[8], committed the country to reducing its greenhouse gas emissions by a certain percentage of 1990 levels by 2008-12. A lenient plan that imposes a slight abatement burden on the trading sector, then, necessitates greater abatement of transport and household emissions – abatement that will hit the publics' purse directly. This, along with environmental concerns that are encouraged by environmental groups, motivates the public to desire a heavy abatement burden for the trading sector. However, this motivation is moderated by the knowledge that a heavier abatement burden for the trading sector will lead to higher retail prices of its produce – higher energy prices, for example. The public, believing that the abatement burden imposed on the trading sector should be reasonable, will desire a certain burden (b^P) that reflects this and will view any deviation from this publicly-optimal burden in a negative light. Overall, then, and again

[8] Since the Kyoto Protocol separate member states have made their commitments more ambitious. The UK, for example, committed itself as part of the Kyoto Protocol to reduce its greenhouse gas emissions by 12.5% (relative to 1990 levels) by 2008-12. However, its current public commitment now amounts to a 20% reduction.

using the notation from above: $W_P = W_P(|b^P - b|, d)$, with $W_P^{'}(|b^P - b|) < 0$, $W_P^{''}(|b^P - b|) > 0$, $W_P^{'}(d) < 0$ and $W_P^{''}(d) > 0$.

The trading sector and the public are both players with multiple goals – they are both concerned with both the abatement burden to be imposed on the trading sector and the degree to which allowance allocation is differentiated to take account of the specific characteristics of the different activities. It is important to stress at this stage that these variables do not enter their welfare functions in a simple additive way. As noted above, both have a diminishing effect on welfare, but they are also perfect complements. The negative opinion of the public, for example, is only allayed by both a reduction in the deviation of the abatement burden imposed on the trading sector and a reduction in the degree to which allowance allocation is differentiated – a reduction in only one of them does not reduce the political damage caused. Likewise, for the trading sector, welfare is only increased if there is both a reduction in the abatement burden it will bear and an increase in allowance allocation. This assumption, which may not accurately reflect reality, has been made for the mathematical tractability of the model but does not significantly alter the results from the analysis.

Finally, the government wants to maximise the welfare that it acquires from the combined direct lobbying efforts of the bureaucracy, the trading sector and the environmental groups; but whilst minimising the negative opinions about the plans design amongst the public, and the political damage that provokes. This is formally outlined in Section 4.

4. DIRECT COMPETITION FOR POLITICAL INFLUENCE

Following stage one, the bureaucracy, the trading sector and the environmental groups, taking the interests of the other players as given, each offer the government a scheme of policy-contingent political contributions. These schedules, which are continuous, outline the political contribution for every possible combination of the abatement burden imposed on the trading sector and the degree to which the plan is differentiated. These contributions are usually interpreted in the literature as taking a monetary form, but in this situation should perhaps be interpreted more broadly as being political support, which may or may not involve financial donations. These contributions are determined by the effect of the plan on welfare, and so if C_B, C_T and C_E denote the contributions from the bureaucracy, the trading sector and the environmental groups, respectively: $C_B = C_B(d^B - d)$, $C_T = C_T(b, d)$ and $C_E = C_E(b)$, with the first and second derivatives being of the same signs as for the welfare effects in Section 3.

It is important to note that the although the total effectiveness of the political contribution schedules rise as the total contributions offered is increased, the effectiveness of a marginal increase in the total contributions offered is characterised by diminishing returns – the offering of a limited political contribution schedule by a new player has a greater influence on the government than if those contributions were added to the more generous schedule of an existing player, even

though the latter will inevitably have a greater overall influence. Each player designs its contribution schedule to maximise its own net welfare: $NW_i = W_i - C_i$ where $i = B, T$ *and* E.

It is assumed that each player has an exogenous endowment of resources that it can use for lobbying, which is denoted by Y_i. For the generality of the results from the model, it is assumed that each of the three players able to engage in lobbying have the same endowment, i.e. $Y_B = Y_T = Y_E$. The realism of this assumption is addressed in Section 6. The bureaucracy uses all of its resources for directly lobbying the government in stage two; whereas the trading sector and the environmental groups have to allocate their resources between lobbying indirectly in stage one (denoted L_T and L_E respectively) and lobbying directly in stage two. It should be stressed here, though, that the actual expenditure of these resources on direct lobbying is determined by the policy-contingent political contribution schedules submitted to the government in stage two. As the amount of resources allocated to indirect lobbying is increased, the amount available to offer in the political contribution schedule falls. Taking the environmental groups as an example; if they allocate a high proportion of their resources to indirect lobbying, they will simply have fewer resources to offer the government in stage two and so their contribution schedule will necessarily be less generous throughout.

A benevolent government would set the abatement burden imposed on the trading sector and the degree of differentiation in the plan such that climate policy as a whole is cost efficient – such that the necessary carbon abatement is implemented in the least costly fashion. In this model it is assumed that the government determines these policy variables such that its own welfare, reflected by the objective function in (1), is maximised:

$$G = C_B(\left|d^B - d\right|) + \left(\frac{Y_T - L_T}{Y_T}\right)C_T(b,d) + \left(\frac{Y_E - L_E}{Y_E}\right)C_E(b) - D(\left|b^p - b\right|, d) \qquad (1)$$

Following Bernheim and Whinston (1986) and Grossman and Helpman (1994) the focus is on truthful contribution schedules, which pay the excess of a player's gross welfare over a given reservation level[9]. It is assumed that the reservation levels of welfare (denoted by r_i where $i = B, T$ *and* E), which are constants that distribute the rent between the government and the lobby group, are set optimally and incorporate the resources they expect to spend on lobbying, and so $\overline{C_i} = \max[0, W_i - r_i]$, where the over-scores denote that the contribution schedules are truthful. For simplicity, the over-scores are omitted in the remainder of the model: it is assumed, for mathematical tractability, that schedules are truthful.

The sub-game perfect Nash equilibrium can be characterised by the following lemmas (in the appendix of Yu, 2005, the mathematical intuitions underlying these results are presented):

[9] Truthful contribution schedules everywhere reflect the true preference of lobby groups (Aidt, 1998) and so correctly reflect the contributions that the players would make for every given policy choice by the government. They are employed here because the resulting equilibria are coalition-proof Nash equilibria (Bernheim and Whinston, 1984). In a first-price menu auction (meaning that bidders, in this case the players, pay their announced offers for the allocation ultimately chosen) a coalition-proof Nash equilibrium is one in which: (i) there is no strategy less-costly than the equilibrium strategy for each player to ensure that the given outcome is chosen; and (ii) there is no alternative self-enforcing Nash equilibrium (meaning that players have no incentive to divert from it) that offers Pareto dominating net payoffs to the players. In other words, players working cooperatively would choose the given equilibrium.

Lemma 1*: Taking the contribution schedules and the reservation levels of welfare for the players as given, the equilibrium abatement burden imposed on the trading sector (b*) and the equilibrium degree of differentiation in allowance allocation (d*), simultaneously satisfy (2):*

$$b^* \text{ and } d^* = \arg\max_{b,d} W_B(|d^B - d|) + \left(\frac{Y_T - L_T}{Y_T}\right) W_T(b,d) + \left(\frac{Y_E - L_E}{Y_E}\right) W_E(b) - D(|b^p - b|, d) \qquad (2)$$

Lemma 2: *The equilibrium levels of political contribution by the three lobbying groups* (C_i^*) *are given by (3), (4) and (5).*

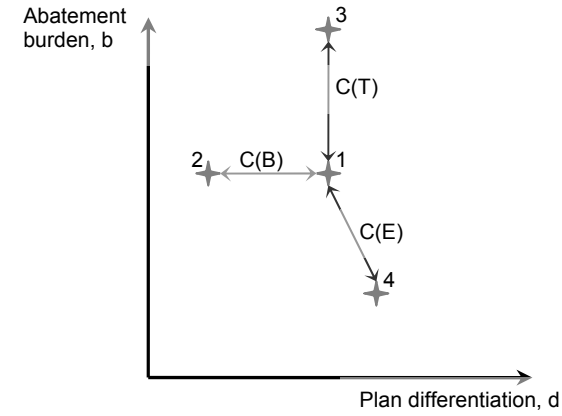
$$C_B^* = [\left(\frac{Y_T - L_T}{Y_T}\right) W_T^{\theta_1}(b,d) + \left(\frac{Y_E - L_E}{Y_E}\right) W_E^{\theta_1}(b) - D^{\theta_1}(|b^P - b|, d)] - [\left(\frac{Y_T - L_T}{Y_T}\right) W_T(b^*, d^*) + \left(\frac{Y_E - L_E}{Y_E}\right) W_E(b^*) - D(|b^P - b^*|, d^*)] \qquad (3)$$

$$C_T^* = [W_B^{\theta_2}(|d^B - d|) + \left(\frac{Y_E - L_E}{Y_E}\right) W_E^{\theta_2}(b) - D^{\theta_2}(|b^P - b|, d)] - [W_B(|d^B - d^*|) + \left(\frac{Y_E - L_E}{Y_E}\right) W_E(b^*) - D(|b^P - b^*|, d^*)] \qquad (4)$$

$$C_E^* = [W_B^{\theta_3}(|d^B - d|) + \left(\frac{Y_T - L_T}{Y_T}\right) W_T^{\theta_3}(b,d) - D^{\theta_3}(|b^P - b|, d)] - [W_B(|d^B - d^*|) + \left(\frac{Y_T - L_T}{Y_T}\right) W_T(b^*, d^*) - D\ (|b^P - b^*|, d^*)] \qquad (5)$$

Where θ_1 is the combination of b and d that maximises the overall political contributions, net of political damage in the eyes of the public, to the government if only the trading sector, the environmental groups and the public are considered. Similarly, θ_2 is the combination of b and d that maximises the overall political contributions, net of political damage in the eyes of the public, to the government if only the bureaucracy, the environmental groups and the public are considered. Finally, then, θ_3 is the combination of b and d that maximises the overall political contributions, net of political damage in the eyes of the public, to the government if only the bureaucracy, the trading sector and the public are considered.

Intuitively, Lemma 2 is based logically on the notion that each player *i* will contribute to the government the exact amount that makes the government indifferent between choosing the combination {*b*,d**} and the combination that would have been chosen if it did not make any contributions – this can also be seen as the effectiveness of the direct lobbying of player *i*. The intuition underlying this is illustrated in Figure 3, which shows how the equilibrium contributions lead to the final equilibrium plan designs being determined. The longer the line representing the contribution of a player: the greater its effectiveness.



1 = b*, d* 2 = $b^{\theta 1}$, $d^{\theta 1}$ 3 = $b^{\theta 2}$, $d^{\theta 2}$ 4 = $b^{\theta 3}$, $d^{\theta 3}$	C(T) = Contribution of trading sector C(B) = Contribution of bureaucracy C(E) = Contribution of environmental groups

Figure 3: The intuition underlying the equilibrium results

From lemmas 1 and 2, the equilibrium values of b^* and d^* are simultaneously determined by the two first-order conditions in (6) and (7).

$$b^*: \left(\frac{Y_T - L_T}{Y_T}\right) W_T^{'}(b) + \left(\frac{Y_E - L_E}{Y_E}\right) W_E^{'}(b) - D^{'}(|b^P - b|) = 0 \tag{6}$$

$$d^*: W_B^{'}(|d^B - d|) + \left(\frac{Y_T - L_T}{Y_T}\right) W_T^{'}(d) - D^{'}(d) = 0 \tag{7}$$

Where $W_i^{'}(.)$ is known as player *i*'s economic stake in the decision. A larger $W_i^{'}(.)$, then, means that player *i* has a greater stake in the decision and so will offer more in political contributions at the margin to influence the decision. As $W_T^{'}(.)$ and $W_E^{'}(.)$ have been scaled by the proportion of their lobbying resources remaining after the indirect lobbying of stage one, these can be interpreted as their effective economic stakes in these decisions.

Before proceeding to the analysis of the indirect lobbying in stage one, it is worth noting the following simple and logical propositions from (6) and (7):

Proposition 1: *An increase in the amount of resources that the trading sector devotes to indirect lobbying in Stage One, L_T, the smaller its effective economic stake will be in the determination of both the degree of differentiation in the allowance allocation of the plan and the size of the abatement burden that it will bear. Ceteris paribus, then, b* will be higher and d* will be lower (as $W_T^{'}(b) < 0$ and $W_T^{'}(d) > 0$).*

Proposition 2: *An increase in the amount of resources that the environmental groups devote to indirect lobbying in Stage One, L_E, the smaller their effective economic stake will be in the*

determination of the size of the abatement burden that will be imposed on the trading sector. Ceteris paribus, then, b will be lower (as* $W_E^{'}(b) > 0$ *).*

Proposition 3: *An increase in the bureaucracy's desired level of differentiation in the allowance allocation of the plan,* d^B*, causes its economic stake in that decision to increase and so, ceteris paribus, will cause d* to rise (as* $W_B^{'}(\left|d^B - d\right|) > 0$ *).*

Proposition 4: *An increase in the publicly-optimal abatement burden imposed on the trading sector,* b^P*: the greater the damage will be of imposing any lenient abatement burden on the trading sector. Ceteris paribus, then, an increase in* b^P *will cause b* to rise (as* $W_P^{'}(\left|b^P - b\right|) < 0$ *).*

5. INDIRECT COMPETITION FOR POLITICAL INFLUENCE

The analysis in Section 4 leads to the final results of the model, but fails to address a number of key questions. (i) How do the environmental groups and the trading sector allocate their resources between direct and indirect lobbying? (ii) What role does the bureaucracy play in the final design of the plan? And, perhaps most importantly as it can be used to test the relevance of the whole model, (iii) what is the predicted outcome of the plan? It is to these questions that the analysis now turns.

Both the trading sector and the environmental groups will allocate their resources between direct and indirect lobbying such that the total effectiveness of their lobbying is maximised. In other words, they will equate the marginal effectiveness of their direct lobbying with that of their indirect lobbying. Let us take the environmental groups first, as they have a single goal variable and so are perhaps the more straightforward of the two.

During stage one, the environmental groups lobby the public in order to encourage them to demand that a heavier abatement burden be imposed on the trading sector. As explained in Section 2, the public demands that this burden be balanced because if it is too lenient, or too heavy, they expect the costs that they themselves will have to bear to rise; and so they demand a particular abatement burden for the trading sector, b^P. The purpose of the environmental groups' indirect lobbying is to increase this publicly-optimal burden by convincing the public that there will also be significant environmental costs that will eventually reduce their standard of living as well.

The publicly-optimal abatement burden is, therefore, an additive function of the public's prior belief about what the abatement burden should be, b_0^P, and the extra burden that they are convinced is necessary to offset future environmental costs, b_E^P, which in turn is a function of the amount of resources that the environmental groups devote to this indirect lobbying. Overall: $b^P = b_0^P + b_E^P(L_E)$. As noted in Proposition 4, increasing b^P will, *ceteris paribus*, raise the equilibrium value of b^*, and so is an effective strategy for the environmental groups to engage in. However, it is assumed that further increasing b^P becomes increasingly difficult as the public increasingly take much more convincing that

the environmental benefits outweigh the increased retail product prices from the trading sector that they fear (and it is also assumed that this effect outweighs the characteristic that $W_P^{"}(|b^P - b|) > 0$).

As noted in Proposition 2, increasing the resources devoted to indirect lobbying inevitably reduces the generosity of the political contribution schedule offered by the environmental groups to the government in stage two, and so will reduce the effectiveness of their direct lobbying. As this, *ceteris paribus*, causes a reduction in b^* they need to equate the marginal effectiveness of the two approaches to lobbying in order to maximise their overall influence on the design of the plan.

Following from the intuition underlying Lemma 2, particularly (5), the total effectiveness of the direct lobbying of the environmental groups is the difference between b* and b^{θ_3}. The marginal effectiveness of the direct lobbying by the environmental groups (MDE_E), then, is given by (8), in which a marginal increase in the direct lobbying of the environmental groups is represented by a marginal decrease in L_E.

$$MDE_E = \frac{\Delta\left(b^* - b^{\theta_3}\right)}{\Delta\left(Y_E - L_E\right)} \tag{8}$$

Similarly, the marginal effectiveness of indirect lobbying by the environmental groups (MIE_E) is given by (9). This is complicated by the fact that the effectiveness of this indirect lobbying works through the government's concern about not creating a negative reaction amongst the public. By increasing b^P, the environmental groups increase the public's influence on the government, which is given by the difference between b* and b^{θ_4}, where b^{θ_4} is the abatement burden that would be imposed on the trading sector if the government was not at all concerned about the public.

$$MIE_E = \frac{\Delta\left\{b^*\left[D\left(\left|b^P - b\right|\right)\right] - b^{\theta_4}\right\}}{\Delta L_E} \tag{9}$$

The environmental groups will allocate just enough resources to indirect lobbying such that (8) is equal to (9). Both forms of lobbying cause the value of b^* to rise – direct lobbying by increasing the political contributions from the environmental groups throughout their political contribution schedules and so making it beneficial for the government to increase the abatement burden; and indirect lobbying by increasing the political damage caused amongst the public by every level of b beneath b_0^P (by widening the deviation of those from b^P). Crucially, it was assumed in Section 4 that the effectiveness of a marginal increase in the generosity of a political contribution schedule is characterised by diminishing returns. For the environmental groups this, along with the fact that increasing the amount of their resources devoted to indirect lobbying causes their effective economic stake to fall; means that increasing indirect lobbying causes the marginal reduction in the effectiveness of their direct lobbying to rise. On the other hand, the assumption that the effectiveness of their indirect lobbying is gradually eroded by the increasing difficulty involved in actually increasing b^P, means that the marginal increase

in the effectiveness of their indirect lobbying will fall as it is increased. The environmental groups, then, will engage in both indirect and direct lobbying (implying that $L_E>0$), allocating their resources between the two such that these marginal effects are equalised.

The analysis regarding the allocation of resources between direct and indirect lobbying by the trading sector mirrors that above for the environmental groups. It too will seek to equate the marginal effectiveness of direct lobbying with that of indirect lobbying. However, this is made more complicated by the fact that it is a multi-goal interest group. Its indirect lobbying is solely focused on the degree to which the plan is differentiated, because that is the only variable that the bureaucracy is concerned about; but its direct lobbying encompasses lobbying for both a lenient abatement burden and a higher degree of differentiation in the allocation of allowances. It has been assumed, though, that the trading sector offers the government a political contribution schedule that encompasses both of these goals and that any marginal increase in contribution requires a favourable marginal change in both the abatement burden imposed and the degree to which the allocation of allowances in the plan is differentiated. Analytically, then, this means that the marginal effectiveness of direct lobbying, regarding both of these variables, can be taken as a single value.

The marginal effectiveness of direct lobbying of the trading sector (MDE_T), regarding both the abatement burden it will bear and the degree to which allowance allocation is differentiated, is given by (10). This is derived in the same way as (8) for the environmental groups, but with θ_2 representing the values of b and d that maximises the overall political contributions, net of political damage amongst the public, to the government if only the bureaucracy, the environmental groups and the public are considered.

$$MDE_T = \frac{\Delta\left(b^* - b^{\theta_2}\right)}{\Delta\left(Y_T - L_T\right)} = \frac{\Delta\left(d^* - d^{\theta_2}\right)}{\Delta\left(Y_T - \Delta L_T\right)} \tag{10}$$

Similarly, the marginal effectiveness of indirect lobbying (MIE_T) is given by (11), in which θ_2 has the same interpretation as for (10). As for the environmental groups, the marginal effectiveness of indirect lobbying is in turn dependent on the marginal effectiveness of the influence of another player – in this case, the bureaucracy.

$$MIE_T = \frac{\Delta\left\{b^*\left[W_B'\left(\left|d^B - d\right|\right)\right] - d^{\theta_2}\right\}}{\Delta L_T} \tag{11}$$

As the trading sector diverts resources from direct lobbying into indirect lobbying, the degree of differentiation in the allowance allocation in the plan desired by the bureaucracy, d^B, is increased. This causes the marginal contribution from the bureaucracy for every degree of differentiation to rise, thereby causing the equilibrium degree of this differentiation to rise. However, this influence is again eroded by the assumption that it becomes increasingly difficult to convince the bureaucracy that it should demand further increases in this differentiation because of its fear that it will not be able to cope with further complexity when it comes to implement and run the Scheme. The marginal

effectiveness of indirect lobbying for the trading sector is positive, but gradually declines (i.e. $MIE_T^{'}(.) > 0$ but $MIE_T^{''}(.) < 0$). On the other hand, and at the same time, diverting more resources away from direct lobbying causes the marginal effectiveness of direct lobbying to rise as fewer resources are being used for it. The trading sector will continue to transfer resources until these two are equal.

The crucial aspect of this analysis is that the marginal effectiveness of indirect lobbying declines more rapidly for the trading sector than it does for the environmental groups. This observation can be made because the value of d^B becomes rigid more quickly than the value of b^P. It is clearer for the bureaucracy that a high degree of differentiation in the allocation of allowances is in its interest and so it already demands a high degree of differentiation before the influence of the trading sector is brought to bear on it, meaning that there is relatively little willingness to further increase it. In contrast, the public is not necessarily aware of the environmental costs and so there is much more scope for the environmental groups to cause the publicly-optimal abatement burden to rise. As the marginal effectiveness of direct lobbying functions have been assumed to be the same for both the trading sector and the environmental groups, this means that the environmental groups will engage in more indirect lobbying than the trading sector, as illustrated by Figure 4.

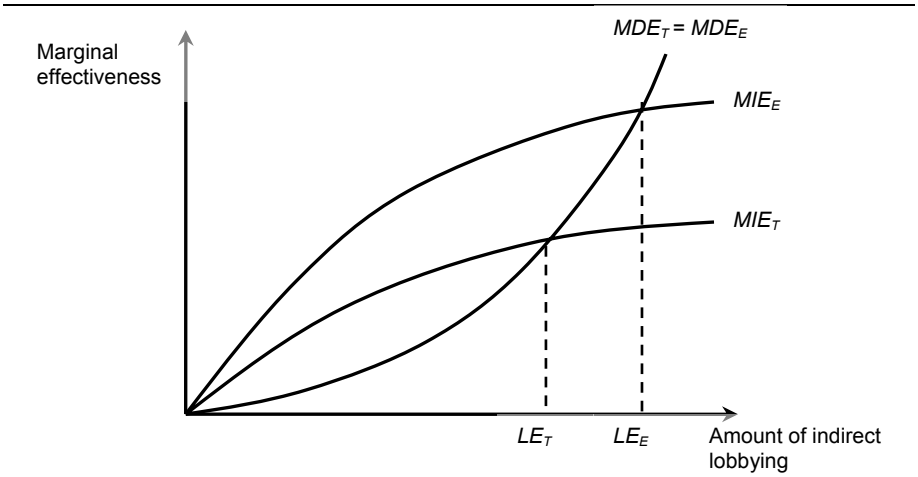


Figure 4: Amount of indirect lobbying by the trading sector and the environmental groups

6. DISCUSSION

The intention of the present paper, as outlined in Section 1, is to analyse why allocation plans in the Scheme have been designed in the way they have, and to assess the role of the national bureaucracy in the design process. The analysis so far has examined how the government makes its final decision regarding the design of the allocation plan; how lobbying by the players involved influences this decision; and how the players allocate their lobbying resources between the two types of lobbying. Regarding the first intention of the paper, then, this leaves one final question: what are the characteristics of the final design and do they conform to the designs that have actually been implemented in reality? To answer this it is necessary to look at the determining equations of the two

plan characteristics that this paper is focusing on – (6) and (7) which are reproduced below for ease of analysis.

$$b^*: \left(\frac{Y_T - L_T}{Y_T}\right) W_T^{'}(b) + \left(\frac{Y_E - L_E}{Y_E}\right) W_E^{'}(b) - D^{'}(|b^P - b|) = 0 \quad (6)$$

$$d^*: W_B^{'}(|d^B - d|) + \left(\frac{Y_T - L_T}{Y_T}\right) W_T^{'}(d) - D^{'}(d) = 0 \quad (7)$$

The analysis in Section 5 concluded that the environmental groups would devote more of their lobbying resources to indirect lobbying than would the trading sector: $L_E > L_T$. This observation, along with the generalised assumption that the marginal welfare effect functions of changes in the abatement burden are of equal magnitudes for both the environmental groups and the trading sector, means that the effective economic stake of the trading sector in the abatement burden decision is greater than that of the environmental groups: $\left(\frac{Y_T - L_T}{Y_T}\right) W_T^{'}(b) > \left(\frac{Y_E - L_E}{Y_E}\right) W_E^{'}(b)$. This, in turn, means that the equilibrium abatement burden imposed on the trading sector will be less than the publicly-optimal abatement burden that now incorporates concerns about the environmental costs of CO_2 emissions due to the indirect lobbying of the environmental groups: $b^* < b^P$. This prediction is precisely confirmed by experience – the allocation plans of the member states of the EU have tended to be more lenient on the trading sector than is economically efficient – i.e. than that necessary to secure environmental benefits in the least-costly fashion.

The influence of the bureaucracy on the degree to which the plan is differentiated, in (7), is for the differentiation in allowance allocation not to deviate from d^B, which has been inflated by the lobbying effect of the trading sector. The influences of the trading sector and the public are in conflict: that of the first is for the degree of differentiation to exceed d^B and that of the second is for it to be less than d^B. It has been assumed throughout the analysis that the players' influences are of equal magnitudes and so, as $L_T > 0$ (meaning that the effective economic stake of the trading sector in this decision is less than that of the public), the equilibrium degree of differentiation will be $d^B < d^* < 0$. There is pressure for the plan to exhibit differentiation but that this is moderated by the influence of the public. A limitation of this analysis is that it fails to identify the economically efficient degree to which the allowance allocation in these plans should be differentiated and so it cannot compare the predicted value to this. However, despite this, the prediction of the model is confirmed by the experiences of the Scheme in reality: the plans have tended to exhibit previously unexpected degrees of differentiation and complexity.

Regarding the second intention of the paper, it is clear that the bureaucracy, and in particular its function in the first stage of the design process, plays a key role in determining the final design of the plan. Figure 5 is similar to Figure 3 in that it shows the final design characteristics chosen. The difference is that, whereas Figure 3 was general, Figure 5 represents the outcome that the model in this paper predicts: with the final plan being characterised by a relatively lenient abatement burden

imposed on the trading sector and a relatively high degree of differentiation in the allocation of allowances.

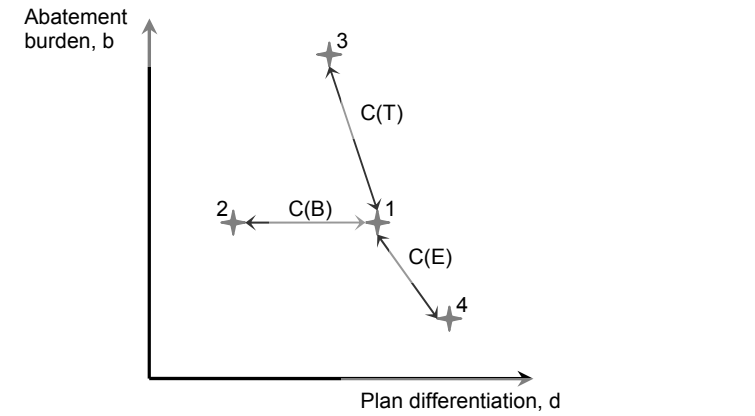


Figure 5: Predicted plan design

The bureaucracy will inevitably be the body to implement, run and monitor the Scheme and so will inevitably lobby the government for there to be a greater degree of differentiation in the allocation of allowances within the plan. However, if the design process is formulated such that the public has a voice in the generation of the design recommendations or if the bureaucracy was relinquished of the task of developing the recommendations (by delegating it to a body that will not subsequently run and monitor the Scheme – a committee of independent analysts, for example), then the influences of both the bureaucracy and the trading sector would be ameliorated, causing the final design to be characterised by an abatement burden closer to b^P (i.e. an increased burden) and a degree of differentiation in the allocation of allowances further from d^B (i.e. a less differentiated plan). These are outcomes that could improve the economic efficiency of the Scheme.

This is an important observation that should inform the design of all public policy – not just that directed towards environmental ends. The influence of the bureaucracy can be significant, particularly if it is able to interact positively with that of another influential interest group (in this case the trading sector) in a way that there can effectively be a division of labour in the lobbying process that maximises the influence that they can bring to bear on the ultimate decision makers. Svendsen (2003) suggests that all bureaucratic departments seek to maximise the cost of policies that they will subsequently be responsible for, as this secures their job-security and enhances their status. The present paper has, for reasons of parsimony, focused on a single bureaucratic department, but Svendsen notes that the situation in which numerous departments compete with one another for status and security can be modelled as a tragedy of the commons problem (Hardin, 1968): each department seeking to secure as much of the public budget as it can. This competition is most clearly illustrated by Irish experiences of allocation plan design: resources given to the Environment

Protection Agency (the lead department in the design) were directly taken from other bureaucratic departments (Barry, 2007). Such competition serves to raise the overall public budget until all net benefit from the budgetary resources is eliminated: too much tax revenue is raised to fund bureaucratic rent-seeking (see Krueger, 1974 for the first exposition of rent-seeking).

7. CONCLUDING REMARKS

Throughout the paper, assumptions have been made to maximise the generality of the analysis: it has been assumed that each of the players, including the public, have the same level of influence on the government; and that all those able to lobby have the same endowment of lobbying resources at their disposal. The fact that the model presented, with these general assumptions, generates predictions regarding these two characteristics of allocation plans that are confirmed by actual experience is a significant strength of it. These assumptions can be relaxed to make the analysis more realistic in three ways. Firstly, evidence shows that the trading sector has a much greater endowment of lobbying resources at its disposal than the environmental groups, and so the effective economic stake of the trading sector could be more highly weighted than that of the environmental groups. Secondly, the public choice literature suggests that the influence of the public is much more limited than that of the lobbying groups because of the nature of the public being an unorganised population. Finally, as the government has specifically delegated the role of developing design recommendations to the bureaucracy, it should perhaps be given a greater effective economic stake as the government more highly values its recommendations. All three of these improvements to the realism of the model simply serve to strengthen the predictions: the abatement burden imposed on the trading sector will be lower, and the degree of differentiation in the allocation of allowances greater, than that currently predicted by the model.

The paper has presented a plausible explanation as to why the allocation plans in the Scheme have taken the forms that they have done; has incorporated the role of the bureaucracy within this; and, perhaps most importantly, has demonstrated that the role of the bureaucracy in the design of allocation plans may be highly significant. The obvious conclusion from this analysis is that the role of the bureaucracy should be taken into consideration when designing environmental policies and perhaps such policies would be more efficient if the body that subsequently implements and monitors them were not given such a great responsibility in determining their design: this would avoid bureaucratic rent-seeking.

From a theoretical standpoint, future work would be beneficially directed towards developing a political economy model that allows predicted policy design outcomes to be compared to the endogenously determined economically efficient outcomes. The model presented in this paper should be seen as a positive step towards that goal. From an empirical standpoint, future work would be beneficially directed towards creating a dataset that can be used to empirically evaluate the influence of national bureaucracies, and private lobbying by other stakeholders, in the determination of environmental policy. The author has spent many an hour searching for such data to facilitate the empirical evaluation of this model, but without success. It is important that economic theory is

falsifiable and so this should be a priority for those working along the boundary of environmental economics and political economy.

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