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Voluntary Agreements in a Rent Seeking Environment

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VOLUNTARY AGREEMENTS IN A RENT-SEEKING ENVIRONMENT

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Abstract. The paper analyses whether voluntary agreements with polluters (VAs) are able to achieve an efficient level of environmental protection when they are obtained under the legislative threat of an alternative stricter policy option. We develop a model in which the threat is a pollution quota. The threat is the outcome of a rent-seeking contest between a green and a polluter lobby group influencing the legislature. We show that a VA systematically emerges in equilibrium and that it leads to a more efficient level of pollution abatement than the legislative pollution quota. However this level is lower than the first best level of environmental protection. The paper also discusses various VA design aspects.

1. INTRODUCTION

In the field of environmental policy, the major policy innovation of the nineties is probably the introduction of voluntary agreements (VA). While they were marginal practices in a limited number of countries beforehand (e.g., in Germany, Japan), they are now used almost everywhere. One illustration of this very fast and widespread development is the first generation of climate change policies adopted in OECD countries around the mid-nineties. They mostly relied on voluntary agreements. Japan set the so-called Keidaren voluntary Action Plan covering 37 industry branches and eighty percent of industrial energy consumption. In the US, the Clinton's Administration 1993 Climate Change Action Program was mainly based on voluntary programs including Green Lights, Climate Wise among many others. In the European Union, almost all Member States launched their own voluntary approaches under various names: branch agreements, covenants, environmental agreements, etc.

Although these approaches differ in certain respects, one common feature is that polluters *voluntarily* commit to undertake pollution abatement activities. The term "voluntary" has long been disputed since many agreements are in fact obtained under the threat of an alternative coercive public intervention. The present chapter deals with these voluntary agreements which are obtained under a legislative threat.

The efficiency of the environmental target embodied in VAs is a major practical concern. Many observers suspect that VAs bring very little environmental improvements beyond the Business-As-Usual trend (e.g., see the recent review of OECD, 2003). The suspicion is due to three features of VAs. First, they are voluntary suggesting that the polluters see them as a cheap solution including little abatement efforts. However, we have seen that, for certain VAs, the relevant benchmark is not a 'do-nothing' scenario but a legislative threat. In this context,

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firms does not enter in a VA because the scheme is cheap but because it is cheaper than the alternative legislative option. The second source of suspicion is that VAs are generally non-binding. Therefore, the regulator lacks enforcement tool in case of non-compliance. Third, many VAs are collective in the sense that they gather a coalition of firms, typically represented by the sector association. This creates free riding concerns which can undermine the cooperation between polluters, and in turn can damage the environmental performance.

The chapter only develops a theoretical analysis of the first argument and assumes that VAs are perfectly enforced and that free riding problems have been solved by the polluters. We develop a model of voluntary agreement in which the threat is a pollution quota and is fully endogenous. More specifically, we model the legislative process whose threat is the outcome. We make the hypothesis that rent seeking affects the making of legislation. Note that this assumption is a necessary condition for the existence of a VA. Otherwise, the regulator would be able to implement the first best legislation and would have absolutely no reason to use a VA. In this politically constrained world, the regulator must choose between two evils: either negotiating a VA with the necessity to reduce the environmental strictness of the VA relative to the first best to obtain the consent of the polluter, or implementing a politically distorted pollution quota.

We investigate whether the VA is likely to lead to a more efficient level of pollution abatement than the level that might have been imposed legislatively. We also investigate various design issues – the opportunity to involve the pollution victims in the negotiation and the efficiency potential of veto rights by the Congress over VAs.

We establish that VAs are always more efficient than the legislation in the politically constrained world depicted by the model. The result is very strong in that it holds true when the world is quasi perfect – when the political constraints are very lax. The underlying intuition is that the polluter is ready to accept a VA that is stricter than the legislative quota. And he does so because the legislative route requires him to make rent seeking efforts. In this context, the model establish that the VA benefit in terms of avoided rent-seeking costs is sufficiently high to make him accept a VA stricter than the legislative quota.

The paper is structured as follows. Section 2 presents the model. In section 3, we establish that the VA is systematically more efficient than the legislative abatement. Section 4 makes two simple extensions of the model to address design issues debated in policy circles: the efficiency potential of involving a green group in VA and the interest of granting a veto right to the Congress over newly adopted VA. Section 5 concludes.

1.1 Economic theoretical literature on VAs

As they have only been developed recently and by practitioners, the theoretical literature on VAs is still limited but it is growing rapidly. Some of these papers deal with the case, similar to ours, where the motivation of the polluters to accept voluntary agreements is the pre-emption of future regulations. Hansen (1999) has developed a political economy model in which polluters negotiate with a regulator under a background legislative threat. The key feature of his approach is that the regulator's objective is biased and differs from that of the threat-making entity, the Congress. A model by Maxwell, Lyon and Hackett (2000) considers firms that voluntarily abate pollution to pre-empt lobbying by consumers in favour of environmental policy. In this case, firms do no pre-empt an explicit threat by a regulator but a risk of new legislation possibly triggered by consumer lobbying. In another paper Segerson and Micelli (1999) develop a normative model in which the polluter undertakes voluntary action under the threat made by a benevolent regulator to implement a pollution quota whose adoption is uncertain. More recently,

In all these papers, political constraints hinder the alternative, legislative, route to the VA, like in ours. In Hansen's paper, the constraint is modelled as a bias of the policy objective of the regulator. In Segerson and Micelli (1999), the constraint is reflected in an exogenous probability of adoption p of the legislation. In the more recent paper by Lyon & Maxwell (2003) the same probability depends on the cost borne by the polluter to meet the legislative requirement, suggesting that the polluters lobby against the legislation. But they do not make explicit the mechanism through which the polluter's cost affects the probability of adoption. Accordingly, these papers yield the same type of ambiguous results: depending on the stringency of the political constraint, the VA is more or less efficient than the legislation.

In these papers, the political constraint is modelled as an exogenous constraint. In particular rent-seeking or lobbying is not explicitly modelled and the polluter incurs no lobbying cost. By contrast, we model explicitly lobbying or rent seeking, even roughly, and show that the endogenous rent-seeking costs are sufficiently high so that the polluter is willing to accept efficient VAs. However, we do not think that the model as such constitutes the proof of the superiority of VAs on legislation. It rather suggests the necessity to make more complex the analysis. In this regard, the fact VAs are non-binding and free riding issues should be taken into account in future works.

2. THE MODEL

The model depicts a situation in which a benevolent environmental regulator R and a polluter P agree to make a voluntary agreement. The VA specifies a pollution abatement level, denoted B, to be met by the polluter. The model is sufficiently general for the polluter to be either a single firm or an industry. In practice, certain VAs are signed with a coalition of polluters, usually represented by an industrial branch association. In that case, the model implicitly assumes that the members of the coalition have solved the free riding problem associated with collective action.

Before going further in the presentation of the model, it is worth making an important remark about the diversity of VAs encountered in reality. The OECD distinguishes three broad categories (1999). Each type ultimately differs with respect to the degree of involvement of the regulator. Under *public voluntary programs*, the firms agree to make abatement efforts to meet goals which are established by the regulator. In a *negotiated agreement*, the polluter and the regulator jointly devise the commitments through bargaining. Under *self-regulation* or unilateral agreements, the polluter takes the initiative. He freely sets up a program of environmental actions without any formal influence from the regulator.

In our model, the agreement is the outcome of a bargaining process between the polluter and the regulator. So, strictly speaking, it is a negotiated agreement. However, our results apply to public voluntary programs. The reason is that public voluntary programs and negotiated agreements share a key feature which ultimately drives the results: the polluter and the regulator's participation constraints must be satisfied in both cases. On the contrary, self-regulation is not a possible application of the model, the main reason being probably that unilateral commitments are usually not triggered by legislative threats.

Consider now the costs and benefits associated with the polluter's commitment to meeting an abatement level B. The abatement cost born by the polluter is described by an increasing and convex function $C(B)$. It also generates a benefit in terms of avoided environmental damage. For the sake of simplicity, we assume that the benefit equals the abatement level B. The linearity of the benefit function simplifies the analysis without altering any of the results. We further assume that $C'(0) < 1$. and $C(0)= 0$. These hypotheses imply that, for low values of B, gross welfare, denoted function $W(B) = B - C(B)$ is positive. Therefore, in the absence of political constraints, the environmental regulator selects the optimal policy level, B^*, defined by the condition:

$$C'(B^*) \equiv 1$$

The agreement is obtained under the threat of an alternative policy. More specifically, we assume that the regulator is the agenda setter of the Congress. He can thus threaten the polluter with a new legislation. The threat consists in a pollution quota that prescribes a minimal level of abatement L for the polluter. We do not assume any cost advantage for the VA: the polluter has the same cost function under the VA and under the legislative quota. Doing otherwise would make it too easy to reach conclusions about the superiority of voluntary agreements.

The threat is uncertain.[1] This is a crucial feature of this type of models: if the benevolent regulator was able to pass any new legislation with certainty, he would be able to implement the first best policy B^* through the Congress and would have no reason to use a VA instead. Let π be the probability of adoption of the legislative quota. It cannot be an exogenous parameter. It certainly depends on the contents of the Law proposal. For instance, for a given level of environmental benefit, a more costly threat has lower chance of being adopted. One central reason for that is that the potential losers of the policy are trying to influence the legislative process through lobbying, media campaigns, etc.

To account for that, we model the legislative process as follows. We suppose that the proposal of legislation is subjected to a rent-seeking contest involving two lobby groups as popularised by the rent-seeking literature. A first group G (the "greens") is concerned by the policy benefit L associated with the pollution quota whereas the second group is simply the polluter *P* who bears the policy cost *C*(*L*). Group *G* and the polluter *P* make rent-seeking expenditures in order to influence the Congress' voting process. Expenditures may be campaign contributions (monetary or in kind), or may correspond to the cost of transmitting strategic information to the "median" legislator on the consequences of the Law proposal. Denote x_G and x_P, the green group's and polluter's rent-seeking expenditures, respectively. These expenditures affect the probability of adoption π via a so-called *contest success function*. Such functions are routinely used in the rent-seeking literature to model lobbying in noisy political environments.[2] As to the functional form, we use a variant of the standard unit logit function pioneered by Tullock (1980):

$$\pi(x_G, x_P) \equiv \begin{cases} \pi^\circ + (1-\pi^\circ)\dfrac{\lambda x_G}{\lambda x_G + x_P}, & \text{if} \quad x_G + x_P > 0 \\ 1, & \text{if} \quad x_G + x_P = 0 \end{cases} \tag{1}$$

where λ is a parameter introducing a heterogeneity in lobby groups' influence technology. It is a routine assumption in the rent seeking literature. When λ lies in between 0 and 1, the green group is less influential than the polluters whereas the contrary holds true beyond 1. π° is a parameter reflecting the responsiveness to lobbying of the Congress. It prevents the probability π to fall below π°. Put differently, whatever the intensity of lobbying, any welfare-improving policy is adopted *at least* with a probability π°. This is a less classical assumption aiming at introducing some concern for the general interest in Congress' behaviour.

To summarize the model, figure 1 describes the VA policy game.

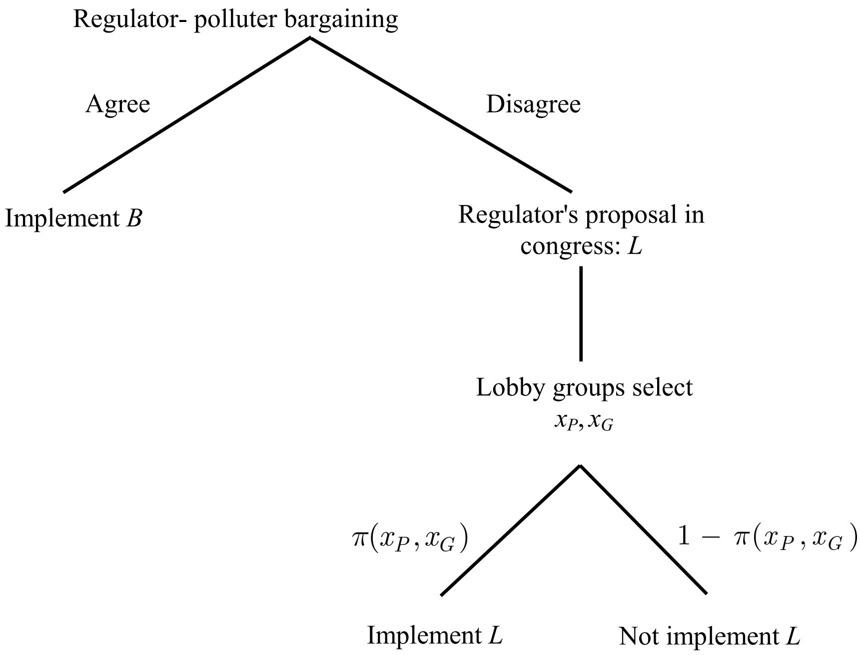

Figure 1. *The decision tree of the VA policy game*

3. RESOLUTION

In this section, we solve the model reasoning backward. We start with the analysis of the rent-seeking sub-game.

3.1 The rent-seeking stage

Consider any Law proposal involving an abatement quota L. What will be its probability of adoption? According to Eq.(1), it is determined by the rent-seeking expenditures of the two groups. Each simultaneously and non co-operatively selects its level of expenditures by maximizing its expected utility, taking the other's level of expenditures as given. The corresponding maximization problem is thus:

$$\max_{x_G} \quad \pi(x_G, x_P) \cdot L - x_G$$
$$\max_{x_P} \quad -\pi(x_G, x_P) \cdot C(L) - x_P$$

The solution to this problem is very classical in the rent-seeking literature (see Nitzan, 1994, for instance) and we will go very fast here. In fact, there are no corner solutions and the equilibrium rent-seeking expenditures is given by the first order conditions:

$$(1-\pi^{\circ}) \cdot L \frac{\lambda x_P}{(\lambda x_G + x_P)^2} = 1$$

$$(1-\pi^{\circ}) \cdot C(L) \frac{\lambda x_G}{(\lambda x_G + x_P)^2} = 1$$

Algebraic manipulations of these two conditions then lead to the following levels of expenditures:

$$x_G(L) = \frac{(1-\pi°)}{\lambda} \cdot \frac{L^2 \cdot C(L)}{(L + C(L))^2} \tag{2}$$

$$x_P(L) = \frac{(1-\pi°)}{\lambda} \cdot \frac{L \cdot C(L)^2}{(L + C(L))^2} \tag{3}$$

Finally, plugging these expenditures in Eq.(1) yields the equilibrium probability of adoption of the rent-seeking game:

$$\pi(L) = \pi° + (1-\pi°)\frac{\lambda L}{\lambda L + C(L)} \tag{4}$$

3.2 The agenda-setting stage

Having characterized the equilibrium probability $\pi(L)$, we identify now the legislative quota that will be proposed to the Congress. The regulator takes into account the fact that adoption is uncertain; he makes a Law proposal that maximizes expected gross welfare:

$$\max_{B} \quad \pi(L) \cdot [\, L - C(L) \,] . \tag{5}$$

Note that rent-seeking expenditures are not an argument in the welfare function. The reason is that we consider that such expenditures are transfers between lobby groups and others (legislators, lawyers, experts, etc.). Another possible hypothesis is to consider rent-seeking as a wasteful activity, which leads to include the corresponding expenditures in the social welfare function. We consider this alternative assumption below in section 3.4. We will see that it does not change the results. We now come back to the maximization program (5). Its first order condition implicitly defines the abatement level under legislation:

$$\pi(L) \cdot [\, 1 - C'(L) \,] = -\pi'(L) \cdot [\, L - C(L) \,] . \tag{6}$$

We then have a very simple lemma which establishes that this level is lower than the first best abatement level.

Lemma 1. *The equilibrium regulatory policy under legislation is strictly lower than the first best policy:* $L < B^*$.

Proof. First we show that π' is negative for all λ, $\pi°$ and L. Differentiating (4) yields

$$\pi'(L) = (1-\pi^{\circ})\lambda\left[C(L) - L.C'(L)\right] / \left(\lambda L + C(L)\right)^2.$$

Furthermore $C(L)$-$LC'(L)$ < 0 because of the convexity of the cost function. It follows that the right-hand side of Eq.(6) is negative. Hence $C'(L)$< 1, or alternatively $C'(L)$< $C'(B^*)$. It implies $L < B^*$. □

This lemma states that the first best policy is not attainable under the legislative route. The intuition is simple. The existence of political constraints lowers the probability of adoption. To mitigate the problem, the environmental regulator needs to make a law proposal departing from the first best optimum. This proposal is lower than B* because of the negative sign of the marginal probability. It is ultimately rooted in the fact that increasing L leads to larger losses in marginal terms than benefits due to the convexity of the cost function. It then provides the polluter with more incentives to increase rent-seeking expenditures.

3.3 The bargaining stage

Note that L, the equilibrium policy under legislation, corresponds to the disagreement point of the bargaining game, which we consider now. In this game, polluter and regulator's payoffs are the differences between their expected utility under legislation and their utility under the VA:

$$U_P(B) \equiv \pi(L).C(L) + x_P(L) - C(B) \tag{7}$$

$$U_R(B) \equiv \left[B - C(B)\right] - \pi(L).\left(L - C(L)\right) \tag{8}$$

Looking at these payoffs, it is immediately obvious that any feasible agreement is more efficient than legislation since it satisfies the participation constraint of the welfare-maximizing regulator. The following result establishes the existence of a unique Nash bargaining solution of the game.

Proposition 2. *Let* $\Omega = \{B : U_P(B) \geq 0 \text{ and } U_R(B) \geq 0\}$. *There exists a unique Nash bargaining solution that solves the following maximization problem*

$$\max_{B\in\Omega} \quad \Pi(B) \equiv \left(W(B) - \pi(L).W(L)\right)\left(\pi(L).C(L) + x^P(L) - C(B)\right)$$

Proof. First we establish that Ω is not empty. It is convenient to denote B_P the maximal level the polluter is willing to accept, which is defined by $U_P(B_P)$= $\pi(L)C(L) + x_P(L) - C(B_P) = 0$. Also, denote B_P the minimal level that the regulator is ready to accept. It is implicitly defined by $U_R(B_R) \equiv W(B_R) - \pi(L)\cdot W(L) = 0$. We have $W(B_R) = \pi(L)W(L) < W(\pi(L)L)$ since $W''(L)$=-$C''(L)$< 0. Then $W(B_R)$ <$W(\pi(L)L$ implies $B_R < \pi(L)L$ since W is strictly increasing below B^*. And so $C(B_R)$ < $C(\pi(L)L) < \pi(L)C(L)$ since C' and C'' are strictly positive. Hence, $C(B_R)$+$x_P(L)$ <

$\pi(L)C(L)+x_P(L)=C(B_P)$. Since $x_P(L)>0$, we finally obtain that $C(B_R)< C(B_P)$ and thus $B_R< B_P$. Hence, $\Omega =[B_R, B_P] \neq \emptyset$.

The second step of the proof is to show that the Nash product is strictly concave. This is straightforward since the second derivative of the Nash product, $\Pi''(B) = W''(B)U_P(B) - 2C'(B)W'(B) - C''(B)\, U_R(B)$, is strictly negative.

Finally, let h be the function describing the utility the regulator obtains for a given utility level of the polluter u_P. The last step of the proof consists in establishing that h is strictly decreasing and concave. From the strict monotonicity of U_P, there exists a unique abatement level $\hat{B} \in \Omega$ such that $U_P(\hat{B}) = u_P$; i.e., $\hat{B} = U_P^{-1}(u_P)$, where U_P^{-1} denotes the inverse utility of the polluter. We can easily get $\hat{B} = U_P^{-1}(u_P) = C^{-1}[\pi(L)C(L)+x_P(L) - u_P]$. Using this expression, the utility the regulator obtains when the polluter obtains u_P is then given by:

$$h(u_P) \equiv U_R(\hat{B}) = U_R\left(U_P^{-1}(u_P)\right) = C^{-1}\left(K - u_P\right) + u_P - \pi(L)L - x_P(L)\,,$$

where $K = \pi(L)C(L)+x_P(L)$. Having characterized h, we can now study the sign of its first and second derivatives. We have:

$$\frac{dh(u_P)}{du_P} = 1 - C^{-1}{}'(K - u_P) = 1 - \frac{1}{C'\left(C^{-1}(K - u_P)\right)} = 1 - \frac{1}{C'(\hat{B})}\,.$$

$$\frac{dh^2(u_P)}{du_P{}^2} = \frac{2}{C'(\hat{B})^2.U_P{}'(\hat{B})} = -\frac{2}{C'(\hat{B})^3}\,.$$

As $\hat{B} < L < B^*$, it follows $C'(\hat{B}) < 1$ and thus $dh/du_P < 0$. Hence h is strictly decreasing. The second derivative is obviously negative and h is therefore strictly concave. ☐

Proposition 2 is the key result of this paper. It establishes the existence of a VA that is more efficient than the legislative (regulatory) option. The result is very robust in that it does not depend on the stringency of the political constraints, as reflected by the values of λ and $\pi°$. In particular, it still holds true when the Congress is very weakly responsive to lobbies' pressure ($\pi° \to 1$) or when the polluter is much less efficient than the green group in influencing the Congress ($\lambda \to +\infty$). However, the VA cannot yield the first best optimum as stated by this simple corollary.

Corollary 3. *Let $\hat{B}$ be the abatement level corresponding to the Nash bargaining solution. We have $\hat{B} < B^*$.*

Proof. Obvious since $\hat{B} \leq B_P < L < B^*$.☐

The result of proposition 2 is very strong in favor of VAs since it still holds true in a quasi perfect world where $\pi° \to 1$ and $\lambda \to +\infty$. As stated in the introduction, it is clearly counter-intuitive since the majority of the observers agree that, in practice, VAs are frequently poorly environmentally effective (see for instance OECD, 2003). Therefore, it is essential to cautiously discuss the underlying intuition. The key point in the proof is that the maximal abatement level the polluter is willing to accept, B_P, is lower than the minimal level of abatement for the regulator B_R. The key reason for this is the fact that signing a VA provides a specific benefit for the polluter which lowers his reservation level: avoiding the rent-seeking expenditure $x_P(L)$.

3.4 A variant: rent-seeking is a wasteful activity

So far we have assumed that rent-seeking expenditures do not enter in the welfare function. We now relax that assumption. Reasoning backward, a first remark is that this does not change the equilibrium probability of the rent-seeking sub-game since the game only involves the polluter and the green lobby group. But, at the agenda-setting stage, the regulator now maximizes:

$$\max_{B} \quad \pi(L)\cdot[L-C(L)]-x_P(L)-x_G(L)$$

We are then able to show that the equilibrium abatement quota is lower than the first best quota like in the previous case.

Lemma 4. *When rent seeking is considered as a wasteful activity, the equilibrium legislative quota is still lower than the first best quota:* $L < B^*$.

Proof. The first order condition of the welfare maximization program is $\pi(L)(1-C'(L)) = -\pi'(L)[L-C(L)] + x_G'(L) + x_P'(L))$. Differentiating (2) and (3) yields:

$$x_G'(L)+x_P'(L)=\tfrac{1-\pi°}{\lambda}\cdot\left[\frac{L^3.C'(L)+L.C^2(L)+L^2.C(L).C'(L)+C^3(L)}{(L+C(L))^3}\right]$$

which is positive. As $\pi' < 0$, then the right hand side of the FOC is positive. It implies $1-C'(L) > 0$ and thus $L < B^*$. □

In fact, the legislative abatement quota is even lower that the one proposed to the Congress when excluding rent-seeking expenditures from the welfare function. This is so because the sum of rent-seeking expenditures is increasing with abatement ($x_G'(L) + x_P'(L) > 0$) as established in the proof of lemma 4. It provides the regulator with an additional incentive to lower B relative to the previous case.

Consider now the bargaining stage. In comparison with the previous version, the change in the assumption only affects the regulator's payoff function which is now:

$$U_R(B) \equiv [B-C(B)] - \pi(L)\cdot(L-C(L)) - x_G(L) - x_P(L) \qquad (9)$$

Looking at this function immediately suggests that the situation is even more favorable to the emergence of a VA than the previous case since the legislative option now entails an additional cost, $x_G(L) + x_P(L)$, to the regulator. A simple comparison of (9) and (7) establishes that the minimal level the regulator can accept, B_R, is lower than in the previous case. In other respects, the maximal abatement for the polluter B_P remains unchanged. In the end, $B_P > B_R$ still holds meaning that the bargaining set is never restricted to the disagreement point. This is the key element of the proof of a new proposition 5. The rest of the proof is left in appendix.

Proposition 5. *When rent seeking is considered as a wasteful activity, a VA systematically emerges in equilibrium and yields a level of abatement always more efficient than the legislative quota.*

Proof. See in appendix. □

4 DESIGN ISSUES

Having shown that the VA systematically dominates regulation in a second best world where legislative action is constrained by lobby groups' influence, we use the model to analyse two design issues that arise in the policy debate on VAs: the efficiency potential of involving environmental associations in the negotiation, and the interest of an ex post veto right of the Congress over any new VA.[3]

4.1 Associating the green group to the VA

A frequent criticism is that VAs exclude the pollution victims from the negotiation. In this respect, they diverge from classical Coasean bargaining in that not all affected parties are around the table. The Coase theorem then suggests that it would improve welfare to include them in the process. The involvement of green associations in the negotiation of VAs is a recurrent policy recommendation even though it rarely happens in practice (OECD, 2000). Does our model plead for such a recommendation? To answer the question, it is necessary to compare the bargaining outcome of the traditional 2-party VA analysed in the previous section with that of the 3-party VA game involving a green group representing the victims. The payoff to the green group in the bargaining game is

$$U_G(B) \equiv B - \pi(L) \cdot L - x_G(L)$$

No simple equilibrium concept is available for 3-player bargaining games without side payments. To bypass the problem, we assume that bargaining only takes place between the two lobby groups. The environmental regulator only influences the outcome through his participation constraint which still needs to hold. Hence, he has no bargaining power and plays a role of arbitrator (or facilitator) of the negotiation. This hypothesis about the allocation of bargaining power actually corresponds to that of a Coasean negotiation. With this assumption the maximization problem of the three-player game is:

$$\max_{B\in\Gamma} \Pi_{ter}(B) \equiv U_P(B)\cdot U_G(B)$$

where $\Gamma = \{ B : U_G(B) \geq 0 \} \cap \Omega$.

The following result establishes the existence of the bargaining outcome of the three-player game and states that it is more efficient than the traditional bilateral VA.

Proposition 6. *There exists a unique abatement level, denoted* $\tilde{B}$*, which is the outcome of the 3-party VA. Furthermore, this outcome is always closer to the first level that the bilateral VA, that is* $\hat{B} < \tilde{B} < B^*$ *for any* λ *and* $\pi°$*. Hence associating the green lobby group to the VA negotiation is welfare improving.*

Proof. Establishing the existence and uniqueness of $\tilde{B}$ follows closely the proof of Proposition 1 and is thus left in appendix. As regards the second part of the proposition, consider the Nash product of the 3-party VA game:

$$\Pi_{ter}(B) = \Pi(B) + \left[\pi(L)\cdot C(L) + x_P(L) - C(B)\right]^2$$

Its first derivative is

$$\Pi_{ter}'(B) = \Pi'(B) - 2((\pi(L)\cdot C(L) + x_P(L)) - C(B))C'(B).$$

As $\hat{B}$ is the maximum of $\Pi(B)$, then $\Pi'(\hat{B})=0$. Hence we have $\Pi_{ter}'(\hat{B}) = -2((\pi(L)\cdot C(L) + x_P(L)) - C(\hat{B}'))C'(\hat{B}')$, which is strictly negative. It implies $\hat{B} < \tilde{B} < B^*$.□

The involvement of green groups in VAs is a relevant policy recommendation because, in the case of a simple VA excluding the green group, the participants are the polluter – who only cares about abatement costs - and the regulator – who is concerned with both costs and benefits. In this setting, the cost is taken into account twice in bargainers' payoffs while the benefit is only counted once. This is reflected in the bargaining outcome which places more weight on the cost side. Involving the greens - who are only concerned with the benefit - suppresses this distortion since costs and benefits are both taken into account twice in participants' payoffs.

The intuition behind proposition 6 may be used for discussing a related design aspect. In practice, the government often delegates the negotiation of VAs to specialized environmental agencies (e.g., the EPA in the US) or Ministries of the Environment. In comparison with the ideal benevolent regulator of the basic model, it is reasonable to assume that these entities are biased in favour of the environment.

Proposition 6 suggests that such a policy delegation and the bias it introduces in the objective of the bargaining regulator in fact promote the efficiency of the VA. Put differently, an inefficient regulator leads to more efficient VA outcomes. The reason is the same as the one justifying the involvement of the greens in VAs. A pro-environment regulator pays more attention to the benefit than to cost, resulting in a more efficient bargaining outcome. There exist instances where VA are in fact delegated to the ministries or agencies in charge of industrial or economic affairs. The Dutch CO2 Long Term Agreements is a possible example. Our model suggests that it is not the best institutional option.

4.2 Granting a veto right to the Congress

A further design question refers to the interest of granting a veto right to the Congress over every new VA. Belgium or the Netherlands are countries which have already adopted this rule. The underlying rationale is to compensate for the lack of democratic legitimacy of the VA process as compared to traditional legislative action. Is it justified on economic efficiency grounds? In our setting, it adds a further (veto) stage to the sequential game. At this final stage, we must assume that, like any proposal made in the Congress, the adoption of the VA is the subject of a further rent-seeking contest between the two lobby groups.

Basically, there is no difference with the rent-seeking sub-game analyzed in section 3.1. The probability that the VA is definitively adopted is therefore equal to $\pi(B)$ given by Eq.(4) and the corresponding rent-seeking expenditures are $x_P(B)$ and $x_G(B)$ for the polluter and the green group, respectively given by Eq.(2) and Eq.(3). Moving on to the bargaining sub-game, the bargainers' payoffs are now:

$$U_P(B) = \pi(L)\cdot C(L) + x^P(L) - \pi(B)\cdot C(B) - x^P(B)$$

$$U_R(B) = \pi(B)\cdot W(B) - \pi(L)\cdot W(L)$$

We then have the following proposition:

Proposition 7. *When the Congress enjoys a veto right, no VA emerges in equilibrium.*

Proof. We keep using B_R to denote the minimal level the regulator is ready to accept with $\pi(L)W(L) = \pi(B_R)W(B_R)$. The left-hand side and the right-hand side of this equation have the same functional form. Furthermore $\pi(.)W(.)$ is strictly monotonic below L. Hence $B_P = L$.

Consider now B_P defined by $\pi(L)C(L) + x_P(L) = \pi(B_P)C(B_P) + x_P(B_P)$. The same argument would apply to establish that $B_P = L$ if $\pi(.)C(.) + x_P(.)$ is monotonic. To show that this is the case, consider the Nash product $\Pi(B) = U_P(B)U_R(B)$. If there exists a VA, the corresponding equilibrium abatement level $\hat{B}$ satisfies $\Pi'(\hat{B}) = U_P'(\hat{B})U_R(\hat{B}) + U_P(\hat{B})U_R'(\hat{B}) = 0$. As $\hat{B}$ is below L, we have $U_R'(\hat{B}) > 0$ and thus $U_P'(\hat{B})=-(\pi(\hat{B})C(\hat{B})+x_P(\hat{B}))' < 0$. Therefore, $\pi(.)C(.)+x_P(.)$ is monotonic and $B_P = L$. In the end, $B_P = B_R$ and the bargaining set is restricted to the disagreement point. □

Therefore, introducing a veto right damages social welfare by preventing VAs from emerging in equilibrium. Intuitively, this is so because, in the absence of veto right, the gains for both sides are ultimately rooted in bypassing the legislative route. Offering a veto on the result of the negotiation *de facto* re-introduces the legislative option in the VA route. As a result, the interest for making a VA vanishes for both parties.

5. CONCLUSION

We have developed a model of voluntary agreement under legislative threat wherein the regulator sets the threat while its probability of adoption is the outcome of a rent-seeking contest between the polluter and a green group influencing the legislature. The model establishes that, in this setting, the VA systematically achieves a more efficient level of environmental protection than the pollution quota that might be imposed legislatively. However this level is lower than the first best outcome. This non-ambiguous result is ultimately driven by the fact that the polluter is willing to accept a sufficiently strict VA. The reason is related to the political constraints under the legislative route. Rent seeking in Congress entails rent seeking costs to the polluter that he avoids when making a VA.

We also use the model to analyse a set of design issues that are frequently discussed in the policy arena. First, it is shown that involving a green group in the negotiation of the VA improves welfare. The underlying intuition is that this (partly) compensates for the bias in favour of pollution abatement cost attached to the participation of the polluter in the VA decision process. A second extension of the model assesses the relevancy of granting a veto right to the Congress over each new VA as done in certain countries (e.g., Belgium, the Netherlands). The model demonstrates that this prevents the emergence of any welfare-improving VA.

All in all, these results are quite favourable to voluntary agreements in comparison with the traditional Command and Control approach. However, we do not believe that they establish the superiority of Vas over legislative quota. These results should simply invite us to relax certain oversimplifying assumptions. For instance, the polluters perfectly comply with their commitments in the model whereas, in reality, many commitments are in fact non-binding. Further work should thus include imperfect enforcement of the VA commitments. Furthermore, the model does not address free riding issues which can hinder the emergence of VAs when, as it is frequent in practice, they involve a group of polluters. A further limit providing the opportunity for future work is that we only consider a threat consisting in an abatement quota. It would be interesting to consider more efficient policy options, such as a pollution tax or an emission-trading program.

6. NOTES

[1] The fact that passing a Law is uncertain is definitively supported by evidence. During the last legislative term in France (1997-2002), the Government made 476 Law proposals out of which 351 were finally adopted by the Parliament, corresponding to an average probability of adoption of 0.74. In the US, a paper by Zeckhauser (1981) gives many examples in the field of environmental policy.

[2] Nitzan (1994) is a comprehensive survey of the rent-seeking literature using such contest success functions.

[3] A report by OECD makes a comprehensive review of these policy issues (1999).

7. REFERENCES

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APPENDIX

Proof of Proposition 1bis

We have already established that the bargaining set is not restricted to the disagreement point. Now we need to show that the Nash product, denoted Π °, is strictly concave. The second derivative of Π ° is equal to $\Pi°''(B) = -C''(B)\,[U_P(B) + U_R(B)] - [C'(B)\,(1 - C'(B)]^2$, which is obviously strictly negative. Finally, let f be the function describing the utility the regulator obtains for a given utility level of the polluter u_P. The last step of the proof consists in establishing that f is strictly decreasing and concave. This is immediate since this function is the same as the similar function h of the previous version except a constant term $f(u_P)= h(u_P) - x_P(L) - x_G(L)$. Hence f is strictly decreasing and strictly concave just like h.☐ there is a symbol I cannot read

Proof of Proposition 2

First we show that Γ is non-empty. Let B_G denote the abatement level corresponding to the green group's participation constraint, that is $U_G(B_G) \equiv B_G - \pi(L)\cdot L - x_G(L) = 0$. We use the notation as in proposition 1 for the abatement levels corresponding to the polluter's and regulator's participation constraints, B_P and B_R respectively. Proposition 1 has already established that $B_R<B_P$. Therefore, for Γ to be non-empty only requires that $B_G<B_P$, i.e., both polluter's and green group's participation constraints hold. From $U_G(B_G)=0$ follows that $x_P(L) = C(L)(B_G - \pi(L)L)/L$ since $x_G(L) = L \cdot x_G(L)/C(L)$. Plugging $x_G(L)$ in $U_P(B_P) = \pi(L)C(L) + x_P(L) - C(B_P) = 0$, we obtain that $C(B_P) = (C(L)/L)\cdot B_G$ and thus $C(L)/L = (C(B_P)/B_P)\cdot(B_P/B_G)$. From $B_P < L$ and $C''> 0$, it follows that $C(L)/L < C(B_P)/B_P$. Hence $B_G<B_P$. Γ is thus non-empty.

Second it is straightforward to show that the Nash product is strictly concave: $\Pi''(B) = -C''(B)U_G(B) - 2C'(B)$ <0. Last, we need to establish the existence and uniqueness of the equilibrium. If g denotes the green group' utility, we have to show that it is a strictly decreasing and concave function of the polluter's utility u_P. We have:

$$g(u_P) \equiv U_G\left(U_P^{-1}(u_P)\right) = C^{-1}(K - u_P) - \pi(L)L - x_G(L),$$

where $K = \pi(L)C(L) + x_P(L)$. The first and second derivatives are respectively:

$$dg/du_P = C^{-1}{}'(K - u_P) = -1/C'(L)$$

and $$dg^2/du_P^2 = -2/C'(L)^3,$$

which are both strictly negative. Therefore the Nash bargaining solution exists and is unique. □