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**GOVERNMENT FAILURE – THE CAUSE
OF GLOBAL ENVIRONMENTAL
MISMANAGEMENT**

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Government Failure - the Cause of Global Environmental Mismanagement

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ABSTRACT:

Pollution and polluters can move across national boundaries, but governments which seek to maximize social welfare should coordinate optimal environmental protection through transfer payments or commitments. However, governments may respond to political pressure rather than maximize social welfare, in case the environment is likely to be downgraded due to asymmetric costs, unborn generations, and asymmetries in information. Government failure in one country may reduce the optimal level of cleaning in another country. The findings are applied to atmospheric emissions, deforestation, consumption of tobacco, and the role of multinational corporations. It is suggested that sustainable development should be supported through an international institution which compensates for government failure.

Government Failure - the Cause of Global Environmental Mismanagement¹

I. Introduction

It is often stated that the lack of property rights causes excessive damage to the environment. Because environmental impacts tend to be external in nature there are no monetary transactions compensating for the gains or losses in welfare. With no market mechanism in operation agents take environmental impacts into consideration only if regulated by law or action taken by those affected. In this paper, however, it is argued that this alone does not explain environmental mismanagement.

Today, the international (or global) dimension of the environment is coming into focus. The earth consists of sovereign nations which create their own jurisdictions, but share a partly common resource basis. There are two sides to the international dimension of the environment. Firstly, the costs of degradation may transcend the national boundaries, meaning that they are inflicted not only upon the country which is responsible for damage. Secondly, polluters may themselves move between countries. These state of facts are often argued to dampen the ability of individual countries to require pollution abatement. Ward and Dubos (1972) and Dasgupta (1976) pointed out that the uncoordinated behaviour of individual nations with respect to common resources may result in global irrationality. On the other hand, countries may compensate each other through transfer payments, or coordinate their policies through binding commitments if this is in their interest.

This paper analyses the international dimension of the environment with the aim of tracing the cause of global environmental mismanagement. It will be shown that governments motivated by maximization of social welfare should secure a sound management of the environment, in some instances through transfer payments, in others through the acceptance of binding commitments. Still, there need not be optimal management of the global environment. The reason is that the political process is likely to downplay the benefits of pollution abatement, resulting in government failure.

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Furthermore, it is shown that government failure within one country may reduce the optimal level of pollution abatement in another country.

The paper is organized as follows. Section II discusses the problem of maximizing social welfare through pollution abatement in a continuous two-country case when there is transferable pollution. Section III introduces a dichotomous choice of cleaning in a sequential framework. Asymmetries between countries are dealt with in Section IV. Section V discusses mobile polluters. The implications of government failure are analysed in Section VI. Four examples of environmental mismanagement are examined in Section VII. Section VIII summarizes and concludes with some implications for "sustainable development" and how the concept may be operationalized.

II. The continuous choice of cleaning

Market transactions may indirectly, through external effects, cause environmental damage, i.e. production pollution or consumption pollution (often intertwined).² The lack of property rights to the environment makes market transactions compatible with an unlimited degradation of the environment. However, a government may secure a sound management of the environment through a forced internalization of the costs of pollution, i.e. make the responsible agents pay for the damage they inflict. It may not even be necessary for a government to take on the direct responsibility, but a legal system which allows for costless negotiation may do the job (Coase, 1960). But what is the case when the international dimension of the environment is taken into consideration?

To analyse under what circumstances there will be optimal pollution abatement when pollution is mobile, we here investigate the interaction between two countries. Mobile polluters are brought up in Section V. Throughout, it is assumed that environmental damage can be identified, quantified and valued in social terms. Social welfare, w , in country j is written

$$(1) \quad w_j = \varphi_j(a_j x_1 + b_j x_2) - c_j(x_j); \quad j = 1, 2$$

where x is the level of pollution abatement relative to what would prevail in the absence of any cleaning. a and b are the "strength of externality" parameters, which measure to

² Pollution is here viewed as impacts on the physical or biological environment, including human health, which appear as side-effects of other economic activities.

what extent pollution in either country spreads to the two countries. Pollution affects social welfare through the function φ , while c is the cost function which applies to a reduction in pollution. φ is commonly assumed to be linear with respect to cleaning, and it is here set equal to 1 for simplicity. The cost function is characterized by $c_j' > 0$ and $c_j'' > 0$.

Assuming that the governments are *social*, meaning that their objective functions comply with maximization of social welfare, the Nash equilibrium gives

$$(2) \quad \begin{array}{l} \text{In 1: } a_1 = c_1' \\ \text{In 2: } b_2 = c_2' \end{array}$$

since each country cleans until its own environmental cost equals its marginal cost of cleaning. This is suboptimal if a_2 or b_1 is greater than zero, since those external effects are not taken into consideration. Thus, mobility of pollution makes a country willing to pollute more than it otherwise would, since it does not carry all the costs itself. A discrepancy arises between what is optimal from the view-point of each country and what is best for them collectively. Hoel (1989) even shows that a country's "unselfish" unilateral reduction of globally harmful pollution may lead to higher total emissions, since other countries may find it optimal to increase theirs as a direct consequence of such reduction. But why would countries not coordinate their policies so as to ensure an optimal level of pollution control internationally? The efficient solution is a (x_1, x_2) combination which maximizes $w_1 + w_2$. This gives

$$(3) \quad c_1'(x_1) = a_1 + a_2 = b_1 + b_2 = c_2'(x_2)$$

so that the total marginal benefit of cleaning in each country equals the marginal cost of cleaning. For the emissions to be distributed so that the total costs of the reductions are minimized, we must have $c_1'(x_1) = c_2'(x_2)$. Mäler (1989) calibrates damage cost functions for European countries in an "acid rain game". He shows that the cooperative solution would render considerable benefits for Europe as a whole, but that some individual countries, which are primarily exporters of emissions, would have to be compensated relative to the non-cooperative situation. See Olsson (1988) for other examples in which countries would have to be compensated for the optimal solution to

be achieved. The work of Coase (1960), Buchanan and Stubblebine (1962), and Baumol (1971) among others, suggest that (3) should be achieved given social governments and a possibility for countries to make side payments. In fact, the member countries of OECD in 1972 agreed to the Polluter Pays Principle (PPP) as an instrument of internalizing environmental costs. Except for obvious instances of polluted waters, however, PPP has generally not given rise to outright compensations to the victims of pollution. Rather, there have been many direct transfers in kind - through military or trade concessions - from a victim country in order to prevent pollution in another country.

In practice, there may be considerable problems to achieve an optimal solution. The distribution of costs and benefits may be skewed not only between countries, but also in terms of how various groups within a society are influenced. Furthermore, instead of conforming with a continuous framework, implementing cleaning is often a question of whether to make sizeable investments at a certain point in time. Is old equipment or a whole factory to be replaced, or is a new scheme of incentives or property rights to be instituted? In order to demonstrate the implications of these state of facts, the next sections investigate dichotomous choices faced by two countries within a sequential framework. The combination of cleaning which minimizes the total abatement and social environmental damage cost across countries is referred to as the *social cooperative solution*.

III. A dichotomous choice by symmetrical countries

In the following, we identify two groups within each country, those who suffer from pollution, and who consequently gain from cleaning, and those who pay for cleaning. To make things simple, each country is assumed to face a dichotomous choice whether to require pollution abatement - "clean" - or not. This means that there are four possible combinations depending on whether each country institutes pollution abatement or not. Furthermore, assume symmetry in the distribution of the effects of pollution in either country. As will be commented on, this construction involves no loss in generality. Thus, (1) is replaced by

$$(4) \quad w_j = \alpha_j(x_1 + x_2) - \beta_j(c_j); \quad j = 1, 2$$

where α is the weight in the welfare function of those who gain from cleaning, and β the weight of those who pay for it.

In the following, the cleaning chosen by the two countries is determined under different circumstances. As the outcome is dependent on the parameter values and model structure which pertains to a specific situation, we use examples to illustrate some points which should be of general interest. The parameter values given in Table 1 are used throughout. ii) differs from i) only in that the welfare weight of those who suffer from pollution is lower. To begin with, it is noted what outcome prevails in a Nash (1950) equilibrium, whereafter I turn to a sequential game. As pointed out by Rogoff (1990), models dealing with coordination of policies tend to assume either that governments can make binding commitments, or that they have no ability at all to do so. In the sequential game set up here, we take note of the possibility that countries can commit future behaviour, and make side-payments, as well as what will prevail in a non-cooperative game where they cannot do either. This means that commitments and transfer payments are treated as alternative means of coordination. The equilibrium concept used is subgame perfectness, which is characterized by players' inability to make incredible threats (Selten, 1975).

The extensive form of the full sequential game is illustrated in Figure 1, with payoffs as in example 1i), see below. If there is a difference between the countries, A is taken to value the environment the most, so that A is always thought of as moving first. Along the upper branch, A offers to commit future behaviour (in the examples given this is always an offer that both countries would commit themselves to reduced emissions), and B agrees to this or rejects the offer. In case of rejection we have a non-cooperative game. As illustrated by the two lower branches, A either cleans or does not clean. If A cleans but B does not, A can offer B a side-payment T as compensation for cleaning in B as well.

TABLE 1: Parameter Values.

$x_1 = x_2 = c_i \in \{0, 1\}$, $\beta = 1.4$	
In i) $\alpha = 1.2$	In ii) $\alpha = 0.8$

The four possible outcomes, without inclusion of transfer payments, are illustrated in the normal form in Table 2, with the two cases referred to as 1i) and 1ii). In both, cleaning in both countries represents the social cooperative solution. However, this is not a Nash equilibrium in a non-cooperative game without side payments or an ability to commit future behaviour, as it is always better for one country not to clean when the other does. Thus, $(0, 0)$ is a unique Nash equilibrium in both examples, which represent traditional prisoners' dilemma situations. Neither country institutes pollution abatement, although it would be best for them if both did. Let us consider the outcomes in the sequential game displayed in Figure 1.

In 1i), the two countries will prefer to commit future behaviour, so that both can agree to clean and thereby obtain $(1, 1)$, rather than playing Nash. Commitments do not represent a subgame perfect equilibrium, however. It is better for B not to commit, but let A go ahead and clean and then let A pay a compensation to B for doing so. Threats by country A not to clean or pay compensation are not credible. In the unique subgame perfect equilibrium, A pays $T = 0.2$ (or infinitesimally more), so that the two countries obtain approximately the pay-offs 0.8 and 1.2 respectively. There is no way any player can improve his outcome by deviating from this equilibrium. If the two countries are to commit themselves to cleaning in this set-up, A must be precluded from making any side-payments to B.

In 1ii), where the environmental cost is lower, we get cleaning in equilibrium only if future behaviour can be committed. It then pays for both countries to commit themselves to cleaning. If they cannot do so, it does not pay for A to clean first, and then pay compensation to B for following. $T = 0.6$ is the smallest transfer which would make B willing to do so, rendering a total pay-off of -0.4 for A. Thus, transfer payments cannot realize the optimal outcome in this case.

The "free-riding" effect can consequently be said to be greater in 1ii) than in 1i), although pollution is less troublesome in that case. In 1i), the optimal outcome is attained either through transfer payments or, if such payments cannot be made, through a commitment by both countries to clean. In 1ii), compensatory payments do not help out, but the optimal outcome is achieved only if both countries can commit future behaviour. An ability to make binding agreements may consequently be necessary for the social cooperative solution to be achieved. In other cases, binding commitments will not be accepted but some countries await transfer payments instead.

FIGURE 1: Sequential Bargaining, Extensive Form.

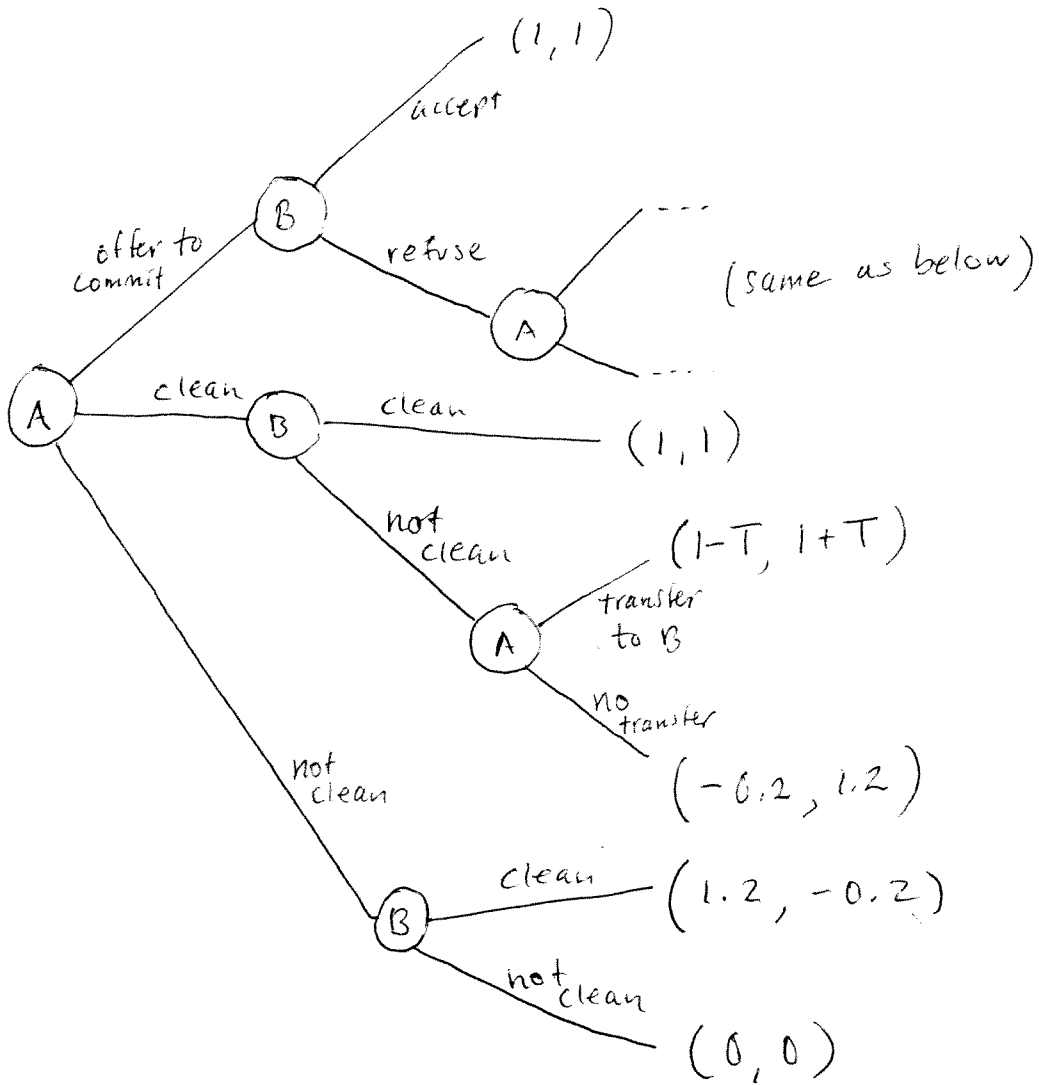


TABLE 2: Pay-offs to Symmetrical Countries, Normal Form, Social Governments.

<u>1i)</u>	B (not clean)		B (clean)	
A (not clean)	0	0	1.2	- 0.2
A (clean)	- 0.2	1.2	1.0	1.0

<u>1ii)</u>	B (not clean)		B (clean)	
A (not clean)	0	0	0.8	- 0.6
A (clean)	- 0.6	0.8	0.2	0.2

IV. Asymmetric countries

What about the case when countries are asymmetric? For example, countries may be differently affected by the costs and benefits of pollution abatement. In addition, there may be asymmetries in priorities. For example, the standard of living tends to be positively related to the social value of the environment, since the urgency of other problems makes environmental protection less of a priority, cf. UNCTC (1985). To investigate the role of asymmetries, assume that the welfare weight α is multiplied by a factor 1.5 in country A only. This is illustrative of any asymmetry that makes country A more gravely affected than country B by pollution. Again, applying the parameter values in Table 1, we get pay-offs as in Table 3, here with the two cases referred to as 2i) and 2ii). As before, cleaning in both countries represents the optimal outcome, but under what circumstances does this prevail?

In 2i) the Nash equilibrium is (0.4, 1.2), meaning that A cleans but not B. In 2ii), where the environmental cost is lower, no cleaning in either country (0, 0) is the unique Nash equilibrium. Applying the extensive form in Figure 1, country B will not agree to a binding commitment in either case. Throughout, A finds it optimal to clean anyway, and then pay B a compensation for following, amounting to at least 0.2 in 2i) and 0.6 in 2ii). The necessary side-payment is larger in the latter case, although the environmental cost is then lower for both countries. Again, it is not a credible threat by

TABLE 3: Pay-offs to Asymmetrical Countries, Normal Form, Social Governments.

i)	B (not clean)		B (clean)	
A (not clean)	0	0	1.8	- 0.2
A (clean)	0.4	1.2	2.2	1.0

ii)	B (not clean)		B (clean)	
A (not clean)	0	0	1.2	- 0.6
A (clean)	- 0.2	0.8	1	0.2

A that the country would abstain from cleaning unless B cleans, or abstain from transfer payments. Only if transfer payments are prohibited does it become optimal for B to commit itself to cleaning.

2i) and 2ii) have the same subgame perfect equilibrium as 1i) above. Both large environmental effects and asymmetries between countries dampen the willingness to commit future behaviour, as countries have a strong incentive to squeeze each other for side-payments instead. As before, however, social government will sometimes prefer commitments and sometimes transfer payments, but throughout succeed in achieving the social cooperative solution.

Let us comment on whether there are impediments to transfer payments or to countries' ability to make binding agreements in the real world. Transfers may not have the desirable effect due to moral hazard problems. If a country sees that assistance from abroad can be acquired, it may pretend to downgrade the value of the environment in order to obtain additional payments. In this way, transfers from "victims" to "polluters" may lead to less pollution abatement than would otherwise come about. Moreover, there may be costs to negotiations due to opportunistic behaviour (Gibbons, 1988) or uncertainty between multiple equilibria (Stymne and Andersson, 1990). Finally, countries are sovereign and it could be argued that they cannot commit future behaviour through any contract, as they cannot be forced to abide any way.

None of these possibilities represent a strong impediment to optimal policy coordination in the present context. It is generally straightforward to check what pollution abatement is installed by another country, and transfer payments can be made contingent on a program which realizes investments by the recipient country itself on a scale which corresponds with its social priorities. In the case of costs to negotiation, there are no practical obstacles for governments to meet. If they get stuck in conflicts, it is possible to call in a third party, such as an arbitrator, to settle the dispute. Practically all major countries, or 84 as of 15 February 1990, have signed the U.N. Convention on the Recognition and Enforcement of Foreign Arbitral Awards. The practical experience of national disputes in economic matters shows that the arbitrator institution, in effect, provides an instrument for predictable and uniform ward enforcement throughout most of the world. If countries would anyway have a problem to commit future behaviour, they can provide some kind of "hostage", such as a deposit in a international fund, which could be grabbed if they did not comply with their promises.

Even to the extent that countries for some reason would be unable to cooperate, but persist in behaving non-cooperatively, there are mechanisms for making them agree to an optimal outcome once the time dimension is taken into account. Applying the Folktheorem, it is well-known that cooperative outcomes can be supported by equilibrium strategies in games which are repeated a great number of times. The mechanism at work is that of punishments directed at countries which try to "free ride" on the actions of others.

So far, only one of the international sides of the environment have been addressed. Perhaps the clue to environmental mismanagement is to be found in the mobility of polluters? This possibility is discussed in the next section.

V. Mobile Polluters

Not only is pollution transferable, but polluters may move across national boundaries. The great bulk of trade in technology today occurs within multinational enterprises (MNEs), which own and operate factors of production in different countries. Walter (1972) predicted that environmental pressures in industrialized countries would promote a gradual shift of pollution-intensive activities towards countries with lower control costs, meaning a shift from high-income to low-income countries. Empirical studies have found limited evidence in this direction, however.³ Gladwin and Welles

³ Leonard (1988) points out that those industries susceptible to flight are ailing industries that have experienced slow growth in domestic demand, and which are 'not likely to contribute in any

(1976) argued that the elasticity of investment is low with respect to environmental control costs, while Leonard (1984) argued that firms have adapted through technological innovations rather than relocation of activities across national boundaries.

The question is not only how firms behave, but how firms and countries interact. Countries compete for the attraction of direct investment, and take the behaviour of firms as well as other countries into consideration when designing their policies. The investor/host country game is analyzed in Andersson (1990). It is shown that competition between fully informed host countries which act non-cooperatively prevents them from taxing or in other ways regulating the behaviour of firms so as to prevent or distort their behaviour.⁴ The reason is that a host country must keep its burden on a foreign-owned firm sufficiently low to compensate an MNE for what it would earn from establishing direct investment in the second best country instead. In order to gain something, that country is prepared to forgo all its gains to attract the project. The sunk cost and the discount factor, which are associated with the mobility of investment, determine the level of host country earnings.

Applying this result to pollution intensive direct investment, it was shown that social governments do not sacrifice the environment to attract or retain investment. While a country's investment opportunities relative to other countries, and the mobility of investment, determine how much a country earns from direct investment, its evaluation of the need for foreign exchange versus environmental quality determines the composition of its gains and losses. A country consequently balances one more dollar in pollution abatement against a dollar less of foreign exchange. Given that the benefit of pollution abatement is valued in accordance with social priorities, nothing in this situation motivates a deviation between the marginal cost of environmental protection and the marginal benefit of cleaning.

One might ask how this complies with the common observations that multinational firms are more polluting in developing countries than in the industrialized, but less so than the developing countries' domestic firms. With advantages in technology and management, and an experience of operations in industrialized countries, MNEs tend to have a lower marginal cost curve for pollution abatement than the domestic firms in developing countries. Given that a host country in the Third World puts less priority on the environment than the industrialized home country, it

significant way to the development of countries trying to build their industrial base'.
 4 This is in line with most empirical studies of host country policies and the behaviour of multinational firms. See for example Contractor (1990).

simply requires a lower marginal cost for pollution abatement. An MNE then becomes more polluting here than it is at home, but less so than the domestic firms. All this is perfectly consistent with optimal protection of the environment across countries. Polluters' mobility does not explain mismanagement of the global environment either.

VI. Government failure

Thus, not only does the lack of property rights fail to explain mismanagement of the environment, but the arguments why social governments would not achieve optimal policy coordination can be refuted as well. It must then be asked whether the present conservatism in environmental protection accurately reflects real world conditions. Many environmental costs are uncertain, and not as tangible as costs for food, medicines, or automobiles. Perhaps it is right not to rush ahead and "halt the smoke" or "save the trees", which is more or less the point made by the Economist (1990).

Unfortunately, that conclusion is premature. The reason is that we cannot take for granted that governments are "social", but we must count on what can be denoted "government failure". The school of public choice has made it widely questioned whether economics and politics can be separated.⁵ Many governments weigh in a self-interest in their decision-making, meaning that they base power relatively more in influential groups than less articulate ones. Consider three factors which may induce governments to deviate from the goal to maximize social welfare: 1) asymmetric costs to achieve political pressure, 2) not yet born generations, and 3) asymmetries in information.

Firstly, if a group is to exert political pressure, the members must activate themselves towards that end and seek to coordinate their efforts. Because this takes time and time is scarce, the costs of coordination increase the larger the group. As first argued by Olson (1965), a small group is relatively more efficient than a large one in exerting political pressure. This is highly visible in the growth of non-tariff barriers to trade, through which a few well organized producers manage to dominate the political process and exploit the great number of consumers. Pollution is often caused by a few actors while the costs are dispersed on many, so that internalization of the costs grant many with a small benefit but inflicts a large cost on a few. To the extent that governments react to political pressure rather than maximize social welfare, the

⁵ The school of political economy or public choice seeks the basis of government objectives in lobbying, cartelization and collusion on the part of extra-governmental groups. See Black (1958) and Buchanan and Tullock (1962).

relatively large costs required for the victims of pollution to organize themselves make it likely that they do not take full account of the environment in their decision-making.

Secondly, environmental degradation has often long-term consequences, meaning that a great deal of the loss is carried by future generations, which have no way of influencing the politicians of our time. People care for their children, but all people of tomorrow who are affected by today's decisions hardly have somebody today who stands up and fights for them as forcefully as he fights for himself (adjusted for the discount factor). Long-term effects therefore tend to be downgraded in the political process. The problem is greater the more irreversible effects are, since the possibility of corrections in retrospect is reduced.

Thirdly, environmental impacts are not always rightly predicted, and the final effect may emerge with a time lag, making it unobservable today. Rather than based on knowledge of the exact value of costs, decisions must be based on risk calculations. Moreover, there is likely to be asymmetric information because those responsible for pollution tend to be the most knowledgeable about the consequences, while those hit by (partly irreversible) effects may merely become aware of them in retrospect. The latter then has no incentive to raise political pressure to defend themselves at the time when it is needed. This problem may be aggravated by the possibility of making environmental damage less painful politically by letting it target those who are the least aware of and the least likely to protest their injury. This is particularly the case if publication and criticism of environmental mismanagement can be depressed, which is common in societies without free elections (Boj6 et. al, 1990).

Thus, it is plausible that governments downgrade the environment below its social value. Clearly, this will lead to too little pollution abatement within a country. But what are the implications for the global environment? In the following, I investigate the implications of interaction between one government which is social, and one which downgrades the welfare of those hurt by pollution. To illustrate the possible consequences, adjust the above examples so that the government of B does not use α , but α^* , where $\alpha^* = 0$. The pay-offs in the four examples are as given in Table 4. Those of country A are the same as before, while the government of B throughout perceives a gain of -1.4 when it has instituted cleaning, and 0 when it has not.

As before, the Nash equilibrium is no cleaning in any country in three of the four cases. The only exception is 2i), where A institutes cleaning because the reduction

TABLE 4: Pay-offs in the Case of One Non-social Government.

<u>1i)</u>	B (not clean)	B (clean)
A (not clean)	0 0	1.2 - 1.4
A (clean)	- 0.2 0	1.0 - 1.4

<u>1ii)</u>	B (not clean)	B (clean)
A (not clean)	0 0	0.8 - 1.4
A (clean)	- 0.6 0	0.2 - 1.4

<u>2i)</u>	B (not clean)	B (clean)
A (not clean)	0 0	1.8 - 1.4
A (clean)	0.4 0	2.2 - 1.4

<u>2ii)</u>	B (not clean)	B (clean)
A (not clean)	0 0	1.2 - 1.4
A (clean)	- 0.2 0	1.0 - 1.4

of environmental damage in the country itself is sufficient to finance the cost of cleaning, rendering (0.4, 0) in the unique Nash equilibrium. Here, however, a possibility for the countries to commit future behaviour does not matter, since the government in B would simply view a commitment to clean as a reduction of its pay-off from 0 to -1.4. The only option available to A is to pay B a compensation of at least -1.4 to make it willing to install cleaning, but is A prepared to do so?

It turns out that A's valuation of the environment in 2i) makes it willing to pay this transfer, as it is then better off by taking on the cost of pollution abatement in both

countries rather than suffering any pollution. In the other three examples, the necessary compensation is too expensive for country A. Not only will A abstain from paying compensation to country B for cutting its emissions, but *country A will also abstain from cutting its own emissions*. Thus, the neglect of social welfare in a country not only affects the country's own policy, but it may also have a direct influence on the optimal policy of the other country. Furthermore, the possibility to make side-payments or commit future policies does not ensure an optimal management of the environment when there is government failure.

These conclusions are strengthened when the mobility of polluters is considered. If one country sacrifices its environment, polluters can move there and, hence, avoid the costs of pollution abatement. The cost of requiring pollution abatement then increases for other countries, so that the marginal cost for pollution abatement equals the marginal social benefit at a higher level of pollution.

Summing up, this section has argued that governments may respond to political pressure rather than the objective to maximize social welfare. Because asymmetric costs to achieve political pressure tend to discriminate against those who suffer from pollution, because the yet unborn are underrepresented, and because of asymmetries in information, the political process is likely to downplay the value of the environment. This affects not only the level of pollution abatement required by a country itself, but may also reduce the attractiveness of pollution abatement in other countries where governments are social.

VII. Examples

This section applies the above findings to four plausible examples of mismanagement in the environmental field, and discusses some normative implications. The examples are as follows: i) atmospheric emissions, ii) destruction of the tropical rainforest, iii) consumption of tobacco in developing countries, and iv) the unexploited potential of multinational corporations.

i) Some atmospheric emissions take the form of direct spillovers, i.e. radioactive fallout from Chernobyl in Poland, or acid rain in Scandinavia or Canada due to emissions of sulphur in Eastern Europe and the United States respectively. In these cases it is fairly straightforward to determine which country is responsible for damage. Referring to the PPP-principle, the victim countries tend to argue that the polluters should cut their emissions, or pay for the effects. The international legislation in the

field is not strong, however, and the polluters often neglect the demands. Where the economies of the polluting countries are desperately bad, as in Eastern Europe, the victims now start to pay compensation for pollution abatement.

The most difficult conflicts concern pollution which is genuinely global, meaning that more or less all countries are affected while the contribution of each country's emissions to the global total is limited. Above all, CO₂ and CFCs (chlorofluorocarbons) are believed to cause global heating and damage the earth's ozone-layer. Although the exact scope of the effects is uncertain, an increasing greenhouse effect is known to threaten the climatic stability, cause higher temperatures and raise the sea level, see Bolin et. al (1986). Damage to the earth's ozone layer reduces our defence against the sun's ultra-violet radiation, and increases the risk of skin cancer (particularly for persons with sensitive skin living close to the poles).

The thinning of the ozone layer in recent years has quickened the negotiations on worldwide reductions in CFC-emissions, but polluters have been awarded a number of years to cut them. Meanwhile, developing countries like India and China require large compensations if they are to abstain from CFCs in newly established industries. Otherwise these countries see themselves as carrying a disproportionate share of the economic burden. Particularly the U.S. puts up a fierce resistance against this and, as shown by Bohm (1990), the so-called Montreal Protocol designed to regulate CFC emissions is inefficient, mainly due to too little inclusion of compensatory payments between countries. Meanwhile, cuts in the emissions are delayed or counteracted by differences in countries' regulation. A ban of CFCs in Sweden in 1989, for example, had little effect since the EC did not do the same, and even did not accept a prevention of its exports of such products to Sweden. The Swedish market was consequently captured by foreign producers which did use CFCs.

The emissions of CFCs are not only characterized by asymmetries in the costs and benefits between countries, but above all by asymmetries within countries. A few producers bear the cost of halted emissions, while the risks of environmental damage are spread thin on practically all mankind. The higher valuation of damage to the ozone layer in the developed countries, coupled with the fact that their industries have caused its present degradation *and* that they face the greater risk of damaging effects, seem to motivate transfer payments to make developing countries abstain from CFCs. The resistance suggests that the few producers still have an upper hand in the political process.

Concerning CO₂, certain countries have particularly high emissions, such as the United States and Eastern Europe, but practically all would have to pay high costs for reducing their use of fossil fuels. All countries suffer a risk of being hit by negative effects, but some most probably stand to gain from a greater greenhouse effect, at least in the initial stage. Scandinavia, for example, may enjoy more sunshine, while Bangladesh or the Island states in the Pacific risk, literally speaking, to be swept away by the sea. In this case there is less of a discrepancy within countries. The production and consumption of energy is of such general value that practically all inhabitants would suffer large losses from cuts in the emissions. The interest which is likely to be misrepresented in the political process is that of future generations. If global warming speeds up, future generations will carry enormous costs.

ii) The tropical rainforest is a commercial asset inherent to the countries in which it stands. At the same time, it has a non-commercial value as a source of climatic and atmospheric stability, and as the major reservoir of genetic diversity. At present there is a rapid destruction of the forest.⁶ This probably represents a greater loss than current prices suggest. Using global economic models of supply and demand, Sedjo and Lyon (1990) argue that there will not be any major long-term increases in industrial wood prices. This finding is hardly applicable to tropical hardwood products, however, and steep price rises are already observed in many of the countries which are currently losing most of their forests. As tropical hardwood becomes increasingly scarce, there will most certainly be excess demand and higher prices (Andersson and Boj , 1990).

The direct cause of deforestation is the lack of property rights. Small-holders clear what they see as "no man's land", and large companies clear land to which they are granted temporary concessions. In effect, the governments of developing countries contribute to the deforestation. Repetto and Gillis (1988) describe how governments sell off wood from public lands at deficit-making prices in order to keep fuel prices down, there are tax and trade incentives promoting logging, etc. Even though the reasons vary, it can be noted that all the three factors brought forward as inducing government failure are likely to be present in the case of forest management.

In the countries where the forests stand, it is often easy for the government, or for the ruling class, to make handsome short-term profits from concessions for forestry to foreign or domestic companies. Potential long-term owners of the forest in

⁶ According to WCED (1987), the mature tropical forests have been reduced from 1.5 - 1.6 billion hectares to less than 900 million, and between 7.7 and 10 million are eliminated each year. The Economist (1988) reports that only 10 out of the 33 countries that today export tropical timber products will do so at the end of the 1990s, as the rest will have no forest left.

the country-side, on the other hand, have little political influence. Most of all, the losses are borne by future generations. There are also informational deficiencies concerning the true value of the forest. In the developed countries, losses of climatic stability and genetic diversity are similarly spread on the majority of inhabitants.⁷

Making optimal economic use of the tropical forest is in the interest of the developing countries themselves, even if it may not interest their governments. The developed countries can assist in supplying technology and information which is necessary for efficient industrial forestry. In addition, there should be a pressure for reorganized property rights so that those who cut the trees also are responsible for their long-term management. However, it is not in the interest of the developing countries to weigh in all global effects in their decision making. To achieve the social cooperative solution, the developed countries must pay compensation for the contribution to climatic stability and genetic diversity which pertain to standing forests. One way is to assist in the creation of national parks, and help to maintain them through measures which improve living and working conditions in the countryside, so that small-holders find other sources of living than cutting the trees.

Such measures are necessary if genetic diversity is to be maintained, since even a sound economic use of tropical forests from the view point of the countries in which they stand in many cases wipes out the genetic diversity. They are nowadays organized spontaneously through private, non-profit organizations in some developed countries. Debt-equity swaps, through which relieved debt burdens are exchanged for the creation or maintenance of national parks, represent a powerful measure which has not yet been much used. Such swaps relieve obstacles to growth in the developing countries as well as some of the economic pressure that contributes to deforestation (Raucher, 1989), and leaves relatively little risk for moral hazard problems.

iii) In the case of tobacco, environmental damage is inflicted first and foremost to the consumer of a private good, particularly cigarettes. It may therefore be argued that tobacco does not represent an environmental problem, since it must be up to each individual to decide whether or not he risks his health. The problem lies in imperfections in information.

⁷ Of course, there are some tangible commercial values, e.g. in the form of potential medicines, but these are likely to be unknown at the time of their destruction, and it is also often unknown who would be able to catch them. For the irreversible destruction of currently unknown values one can assess a 'quasi-option value'. However, it is impossible to assign it a precise estimate (Fisher, 1981).

In the past, there was little knowledge of the detrimental effects on health caused by cigarettes. As these have become better known, governments in developed countries have imposed restrictions on advertising for smoking, and actively informed about the risks. Sales have dropped throughout the industrialized world, and the companies that produce and sell cigarettes have instead undertaken massive advertising campaigns in developing countries. The following increase in smoking has become a great burden on the balance of payments for many developing countries, and tobacco has been requested to be grown and processed domestically. The result is a spurt in deforestation as land is cleared for cultivation of tobacco, destruction of soil, and an expected explosion of costs due to premature deaths and medical treatment of diseases caused by excessive smoking.

The marketing of cigarettes in developing countries represents an exploitation of asymmetric information, as the inhabitants in developing countries pay without knowledge of the true effects. Rents accrue to the multinational firms that produce and market cigarettes, as well as to the governments that gain from taxes and possibly from hidden payments for firms' access to their markets. In this case, there is no way to institute a policy which maximizes welfare through transfer payments, as the uneducated and uninformed are exploited both by their governments and private firms in the industrialized countries. This kind of environmental mismanagement must be addressed through international regulation which restricts the right of firms and governments to exploit inefficiencies in information. At the least, appropriate educational programs should be required, as well as a forced internalization of future costs through obligatory insurance schemes.

iv) Multinational firms are the prime innovators and possessors of technologies for pollution control, and they have a great potential for spreading them between countries, particularly to domestic firms in developing countries. As with all technology, however, firms have an incentive to keep it to themselves in order to exploit its advantages. If MNEs are to carry the costs of transferring expensive technology and equipment in pollution abatement across national boundaries, and promote its diffusion to other firms, there must be an economic incentive to do so. Today, consumers are increasingly appreciating "clean" production, but there is seldom an appropriate information on firms' environmental record. If there was, cleaning would become an economic concern for companies, since it would improve their brand name and, in effect, the perceived quality of their output.

In order to fulfill the potential of MNEs for environmental management, it is necessary to cater for generally available information on firms' environmental record. The incentives for development and diffusion of clean technology may be further improved by special awards, in effect transfer payments, to companies that display a particularly good record.

VIII. Summary and concluding remarks

Lack of property rights cannot explain why governments do not coordinate policies so as to ensure an optimal management of the environment. This paper has argued that social governments should be able to do so through either transfer payments or commitments. Greater environmental effects or asymmetries between countries should favour transfer payments and, hence, reduce the use of commitments if such payments can be expected. In any case, there is little reason to expect that either of these options would not be available in the real world.

The plausible cause of environmental mismanagement is that there are governments which are not social, meaning that they do not maximize social welfare. A government may rather respond to political pressure, and there are at least three reasons why the political process is likely to downgrade the value of the environment. Firstly, the costs of pollution tend to be dispersed on large groups which face relatively large costs to organize themselves. Secondly, many detrimental effects on the environment are of a long-term character, and future generations cannot speak for themselves. Thirdly, there are asymmetries in information, which can be exploited. We have further seen that a government which downgrades the value of the environment distorts not only domestic policies. Because pollution can move across national borders, and polluters are mobile across them, government failure in one country may reduce the optimal environmental protection in *other* countries.

The findings have been applied to atmospheric emissions, exploitation of the tropical rainforest, consumption of tobacco, and the role of multinational corporations. It has been argued that transfer payments should be expected from social governments to reduce atmospheric emissions such as CFCs and to preserve the tropical forests. In the case of CO₂, the question is whether future generations are exploited. Informational asymmetries are consciously exploited as smoking is imposed on the peoples of the Third World, and dampen the interest of MNEs to develop and diffuse clean technology.

Throughout, informational asymmetries stand out as critical in paving the way for government failure by enabling pressure groups to distort the political processes. Let us close by relating to the concept of sustainable development, which has become a label for optimal use of the global resource basis since it was launched by WCED (1987). There are different interpretations and definitions of sustainable development, see e.g. Pezzey (1989). The original approach stressed the relationship between poverty and environmental decay in developing countries. Some focus on physical aspects, and reason in terms of keeping the natural resource stock intact (Odum, 1989). Extending from individual species, Dixon and Fallon (1989) speak of the sustainability of ecological and socio-economic systems.

For all this work it is unclear how the concept of sustainable development can be operationalized. This paper suggests, however, that the issue is not to define policy targets. What is needed is a mechanism which compensates for government failure. For this purpose, a super-national organization should be instituted, serving as an arbitrator which not only helps to resolve conflicts but also to identify them in the first place. It should survey and publicize the environmental record of governments as well as firms. Legal constructs and distributions of property rights which enable a few to exploit the many, such as the provision of short-term concessions for exploitation of forests, should be forcefully exposed. Moreover, transfer payments between countries and/or binding agreements should be facilitated and stimulated. Countries could, for example, be asked to deposit membership fees which would be confiscated in case they violated their own commitments.

It would be desirable with an organization which actually acted on behalf of those who cannot be reached by information or who are deprived of political rights. At the same time, there must not be an organization which swells into a huge bureaucratic body - spending on itself the resources which should be used to improve the environment. To some extent, the organization will need to be bigger the less power is awarded to it, as it will then be induced to compensate for that by growing in size. The international community should institute a small, informative, creative *and*, in some instances, powerful super-national body. It should take action which, ultimately, is in everybody's interest, but mainly by letting us all express our true concern as accurately as possible.

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