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# Global environmental problems, efficiency and limited altruism

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**ABSTRACT.** Global environmental problems are often assumed to imply extensive inefficiencies since there is no global authority corresponding to the government at a national level. This paper shows, on the contrary, that rich countries in a free unregulated market may still undertake globally efficient abatement investments, given the existence of limited non-paternalistic altruism.

**Key words:** Global environmental problems, externalities, altruism, transboundary pollution.

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## 1. Introduction

Environmental externalities are often considered to imply a market failure, meaning that the free market in itself will not lead to a Pareto efficient allocation (Baumol and Oates, 1988). In the tradition of Pigou, the standard solution to this problem is some kind of market intervention, and economists have often pointed out the great potential for market-based policy instruments such as tradable permits; see e.g. Carlsson et al. (2000). Global, or multinational, environmental problems are often considered to be harder to deal with, since there is no global authority, corresponding to the government at a national level, that has the authority to implement the preferred policy.

There are several proposed ways of escaping this problem, including the folk theorem of repeated games (Fudenberg and Maskin, 1986), which shows that it may still be optimal to co-operate in prisoner-dilemma type situations if the game is played an infinite number of times, or with a stochastic time frame. However, most environmental pollution is far from symmetric, both spatially and temporally, implying that the folk theorem may not offer much hope in reality. For example, emissions of greenhouse gases are largely caused by rich industrialised countries, whereas a large part of the damage associated with global warming is expected to occur in poor countries (Banuri et al., 1996).

Another solution is possible if the transaction costs are small. In this case co-operative, or partly co-operative, solutions, even in static games, cannot be ruled out. However, the transaction costs associated with transboundary pollution are most often likely to be large. Furthermore, it is not straightforward to generalise the Coase theorem (Stigler, 1966) to many agents, implying that even small transaction costs are not a guarantee for an efficient outcome. In addition, the large asymmetries typically make it more difficult to obtain co-operative solutions.

This note proposes that the free, unregulated market may still result in a globally efficient allocation and abatement because of an alternative motivation: the existence of *limited altruism*. In particular it will be shown that also minor altruistic concern may cause efficient abatement investments. Intuitively, the fact that rich countries give aid to poor countries

reveals that rich countries care about poor ones, or at least that they care about their own contributions to poor countries. If this concern is non-paternalistic and cost-effective, it is optimal for the rich country to internalise all environmental costs imposed on the poor country. The results are derived assuming a non-co-operative Nash-equilibrium in a simple static model of an unregulated global market.

## 2. The model

From a standard economic model it would be rational for the rich country to put no weight whatsoever on the environmental damage occurring in poor countries. On the other hand, we know that rich countries, and many individuals in rich countries, do care about poor countries and their citizens to a certain, albeit limited, extent. Economists are also sometimes puzzled by the fact that countries sign far-reaching international agreements on emission reductions that seem to be against their own interests. A natural extension of the standard economic model, which makes it possible to explain aid and similar phenomena, is to allow for altruism between countries.

Assume that the reason why a rich country cares about the well-being of poor countries can be represented by pure (non-paternalistic) altruism, so that the utility of rich countries increases with the utility of poor countries. The utility functions for the rich country can then be written as a function of its own consumption (or income) level,  $x^r$ , the emission levels in the rich and the poor countries,  $e^r$  and  $e^p$ , and the utility level in the poor country,  $u^p$ , as follows:

$$u^r = u^r(x^r, e^r, e^p, u^p) \quad (1)$$

where  $\frac{\partial u^r}{\partial u^p} > 0$ , whereas utility in the poor country is assumed to be independent of the utility in the rich country:<sup>1</sup>

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<sup>1</sup> The assumption that the poor country is not altruistic towards the rich country is not essential for the results, but it simplifies the formal analysis.

$$u^p = u^p(x^p, e^r, e^p) \quad (2)$$

The emissions depend, among other things, on the abatement  $g$  undertaken in each country, i.e.  $e^i = e^i(g^i)$ ,  $i = r, p$ . The non-co-operative Nash equilibrium includes the maximisation of (1) subject to a budget restriction that total income in the rich country,  $y^r$ , is equal to consumption plus abatement expenditures and a monetary transfer  $t$ , which we may interpret as aid, to the poor country:

$$y^r = x^r + sg^r + t \quad (3)$$

where  $s$  is the per-unit price of  $g^r$  in terms of  $x^r$ . For simplicity we also assume that demand in the poor country is unaffected by the damage caused by the rich country, so that there are no strategic interactions. The necessary conditions for an internal optimum<sup>2</sup> of the rich country, with respect to the choice of consumption, abatement and aid, imply:

$$\frac{\partial u^r}{\partial e^r} \frac{\partial e^r}{\partial g^r} \bigg/ \frac{\partial u^r}{\partial x^r} + \frac{\partial u^r}{\partial u^p} \frac{\partial u^p}{\partial e^r} \frac{\partial e^r}{\partial g^r} \bigg/ \frac{\partial u^r}{\partial x^r} = s \quad (4)$$

$$\frac{\partial u^r}{\partial u^p} \frac{\partial u^p}{\partial x^p} \bigg/ \frac{\partial u^r}{\partial x^r} = 1 \quad (5)$$

Combining (4) and (5) implies:

$$\frac{\partial u^r}{\partial e^r} \frac{\partial e^r}{\partial g^r} \bigg/ \frac{\partial u^r}{\partial x^r} + \frac{\partial u^p}{\partial e^r} \frac{\partial e^r}{\partial g^r} \bigg/ \frac{\partial u^p}{\partial x^p} = s \quad (6)$$

However, this is exactly what the standard Samuelson (1954) efficiency rule would look like in the absence of altruism. Furthermore, it is easy to show that the social efficiency rule with pure altruism looks identical. Maximising (1) subject to an overall budget constraint and holding utility constant in the poor country must yield the same result as maximising (1) and

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<sup>2</sup> The existence of an internal optimum is a reasonable assumption. We would theoretically have a corner solution, implying no pollution adjustment at all, if the marginal abatement costs of the first (least costly) unit were sufficiently large. Similarly, we would have another corner solution implying no resultant pollution at all if the abatement costs of the last (most costly) unit were sufficiently small.

disregarding  $u^p$  in the utility function, subject to the same constraints. This is because the inclusion or exclusion of  $u^p$  in the utility function is not important since both hold the utility in the poor country constant in the optimisation; cf. Bergstrom (1982, 1999). Hence, (6) is also a valid efficiency rule in the presence of pure altruism. This can be compared to the result without altruism where the behaviour of rich countries implies only the first term of the left-hand side of (6). Thus, including a limited degree of altruism not only implies that the rich country will, to a limited extent, include the damage caused in the poor country in the national cost-benefit analysis, but it will include *all* the costs, so that the overall results are in accordance with the conventionally used efficiency rule. Why is this so? The reason is simple: Given that the government in the rich country cares about the poor country, in addition to itself, they would like to help the poor country in a cost-effective manner. And the overall most cost-effective manner is to follow the standard efficiency rule *on the margin*.

The poor country, on the other hand, will of course not internalise any of the externalities caused to the rich country, since it has no incentive to do so in the model. Thus, the poor country will still cause too much pollution from a social point of view.

#### *Impure or paternalistic altruism*

There is much empirical evidence, combined with common sense, suggesting that the pure altruism model is unrealistic (e.g. Andreoni, 1989; Ribar and Wilhelm, 2002). An alternative and more realistic setting is instead what Andreoni terms *impure* altruism, where the utility of individuals is not affected by the utility of other individuals per se, but where people get a “warm-glow” from the pure act of giving. In this setting, people from a rich country, A, get utility from giving money to a poor country, but their utility is unaffected by the fact that another rich country, B, gives money to the same poor country. By contrast, in the pure

altruism model people in country A would get the same utility from an equally large contribution by country B as from their own contribution.

However, it is easy to see that the basic result still holds as long as the impure altruism is non-paternalistic. If this is the case, the rich country will still try to get its “warm glow” in a cost-effective manner, which is to say they would like to obtain a marginal utility increase in the poor country at the lowest possible cost. Furthermore, if it did not fully internalise the costs of the damage in the poor country, say for example that it only took into account half of the environmental costs inflicted on the poor country, then it would clearly be cheaper for the rich country to internalise the remaining costs rather than to increase the amount of aid given to the poor country.

Nevertheless, the result holds only when the altruistic motivation (pure or impure) is non-paternalistic. If, for example, the rich country gets more “warm glow” from giving a certain amount of money to the poor country than from reducing pollution to a degree that would result in a comparable utility change for the poor country, then the rich country would not internalise all the damage costs inflicted on the poor country.<sup>3</sup>

### **3. Discussion and Conclusion**

This note has questioned the conventional conclusion that the non-co-operative market solution, i.e. the Nash equilibrium, implies largely inefficient and excessive pollution behaviour in the presence of transboundary pollution. In particular, it is shown that limited non-paternalistic (pure or impure) altruism will induce rich countries to internalise damage costs caused in other, poorer countries. If the outcome of the poor country had the same weight as that of the rich country in the rich countries’ objective function, this would not be

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<sup>3</sup> In the extreme case where the rich country gets a “warm glow” *only* from giving aid, it would not internalise any of the damage cost caused in the poor country, i.e. we would be back to what the standard model predicts.

very surprising. However, the main point in this paper is that full internalisation may also hold when only a small weight is given to the utility of the poor country. Instead, what is crucial is that the nature of the altruistic concern is non-paternalistic. Whether this is a realistic assumption or not is open for dispute. Given that the rich country (and its citizens, of course) gets utility from contributing to the well-being of a poor country, one must ask whether it is more realistic that the marginal utility increase is higher because of further monetary transfers or because of corresponding pollution reductions. Similarly, one must ask what causes the greatest disutility in the rich country: a small cut in the aid given to the poor country, or a corresponding (in utility terms) transboundary pollution increase? The answer to these questions does not appear to be obvious. On the one hand, one may argue that people in the rich country focus more on the aid, since it is well-known from psychological research that people want to view themselves as being good and responsible, and that we process information to maintain or improve such a self-image (see e.g. Baumeister, 1998). Hence, we may tend to ignore the pollution caused to other countries, applying self-serving biases when judging the consequences of this pollution (cf. Babcock et al., 1996).

On the other hand, one may argue that there are strong social norms, or ethical rules, not to cause harm to others, and there are no equally strong norms saying that we ought to improve the situation for others. There is also much recent experimental evidence suggesting that reciprocity is crucial in human behaviour and that we have preferences over much more than the actual distribution of resources. These preferences include the perceived fairness associated with the process of obtaining this distribution; see e.g. Fehr and Gächter (2000) and Falk et al. (2003).

There are of course other possible motives behind the observed aid to poor countries. Sometimes it is proposed that rich countries give aid to create new markets, which will benefit them in the long run. Although this may be part of the motive in some cases, it appears not to

be a primary motive in most, since it is hard to believe that the rate of return on this money would not be larger if used in domestic investments (e.g. higher education) instead. Another motivation might be international reputation. That is, the rich country may not care at all about the poor country, or about helping the poor country, but it may care about its international reputation among other rich countries, since such a reputation may be beneficial in other negotiating situations. But, even if this is the case, what is essential is still whether the rich country's behaviour, upon which this reputation hinges, is paternalistic or not. If not, and the rich country's actions towards poorer countries are judged to be non-paternalistic, then the argument in this paper is still valid. Nevertheless, the very simple model presented in this paper will not, of course, explain all kinds of aids and their motives in an appropriate way. However, it is illuminating that the fairly realistic assumptions of a limited degree of altruism used *can* have such a profound effect on the cost-effectiveness of abatement for transboundary pollution. This can be compared with other insights from behavioural economics, where small deviations from perfect rationality in terms of time-consistency can have large welfare consequences (e.g. O'Donoghue and Rabin, 1999). Further, the arguments can of course be extended to other kinds of international externalities between rich and poor countries as well.

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