Tradeable CO_2 Emission Permits: Initial Distribution as a Justice Problem

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ABSTRACT: One characteristic of tradeable emission permits is that efficiency and justice considerations can be separated. While Pareto optimality is an accepted efficiency principle, there is not a consensus on a 'best' equity principle. In this article, conventional justice principles are used to evaluate alternative allocation rules for tradeable CO_2 permits, and a distribution proportional to population is recommended. Arguments against the population rule are discussed, especially those pertaining to political feasibility. While justice and political feasibility may indeed contrast, it still may be possible to emphasise the population rule in the future.

KEYWORDS: Global warming, tradeable emission permits, justice principles, political feasibility

INTRODUCTION

The concepts of *efficiency* and *justice* are central in the debate surrounding international environmental agreements, in particular, in the debate on agreements designed to reduce CO_2 emissions. While Pareto optimality is an accepted efficiency principle, there is not a consensus on a 'best' equity principle. As a result, most economic analyses of international CO_2 agreements have concentrated on the efficiency problem. In this article, I focus on the justice problem.

A just international CO_2 agreement is desirable because of the role of justice in general, and because a just agreement may facilitate wide participation. The primacy of justice seems to have been a common philosophical premise in political theory. As argued by Rawls (1971, p. 3), 'Justice is the first virtue of social institutions, as truth is of systems of thought. A theory however elegant and economical must be rejected or revised if it is untrue; likewise laws and institutions no matter how efficient and well-arranged must be reformed or abolished if they are unjust'. The priority of justice may be philosophically

Environmental Values **4** (1995): 129-48

debated. For instance, it often plays a secondary role in economic policy making. Nevertheless, justice will always play an important role as a principle of all social interactions.

Since justice maintains a prominent role in social interactions, it can lead to the establishment of an agreement. It may be difficult to establish an agreement if several countries define it as unjust. Since global warming depends on the total emissions of greenhouse gases (including CO_2) from all countries, it is of great importance that as many countries as possible join a CO_2 agreement. Thus, in addition to the concepts of efficiency and justice, *wide participation* is an important component of international CO_2 agreements. A unifying equity principle, a principle accepted by all countries, may facilitate co-operation and be an important factor in establishing an international agreement.

In this article, I concentrate on tradeable CO_2 emission permits, because these make it possible to separate efficiency and justice considerations. Under the assumptions of a competitive market, cost-effectiveness will result from trade no matter how the permits are initially distributed.[1] By assuming separability of intergenerational and intragenerational justice, that is, justice between generations and within a generation, we can discuss the initial distribution of permits as an *intragenerational distributive justice problem.*[2]

Two metaprinciples of theories of justice, that is principles implicit in all theories of justice, are ethical individualism and presentism. A third generally accepted principle is to avoid morally arbitrary components as standards for distribution. The framework of this article is to use these principles in an exclusionary way, by working with a list of current, competing allocation rules, to evaluate the rules from a distributive justice point of view.

The article is organised as follows. First I analyse the nature of tradeable permits by describing the system and discussing the distribution problem and the relevance to theories of justice. Then different allocation rules are analysed in the light of principles of justice. From the analysis, a distribution proportional to population is recommended. Arguments against this rule are discussed, and in the last section special attention is placed to political feasibility. Conclusions are drawn at the end.

THE NATURE OF TRADEABLE CO_2 PERMITS

Before considering justice principles, I describe the mechanisms of a tradeable CO_2 permit system. I then consider the distribution problem by discussing the characteristics of permits as goods. Finally, I discuss whether the distribution problem is autonomous (i.e., can it be treated independently of other problems?).

The System of Tradeable CO_2 Permits[3]

Assume that a group of countries have agreed to reduce their CO_2 emissions. Regardless of their reduction goal, the group should try to achieve this goal at the lowest possible cost (i.e., the agreement should be *cost-effective*). A necessary condition for cost-effectiveness is that the marginal cost of emission reductions is equal for all countries. To illustrate this condition, assume that for two countries the marginal costs of emissions reductions are not equal. For example, the marginal cost of emissions reductions is £100 in country A and £150 in country B. If country A reduces the emissions by one unit, and country B increases the emissions by the same amount, the total emissions will remain unchanged. However, total costs are reduced by £50; country B's costs are decreased by £150 and country A's costs are increased by only £100. Thus, this distribution of emission reductions involves less costs for the group of countries. If we assume that the marginal costs of emission reductions increase with higher emissions, we may end up with the cost-effective solution. This solution is characterised by lower emissions in country A and higher emissions in country B.

Through the introduction of a tradeable CO_2 permits system, the countries can benefit from trade if the initial permit distribution gives different marginal costs of emission reductions. Returning to the above example, countries A and B will benefit from trade if the price of a permit is between £100 and £150. Say the countries agree on the price of £120. Then, if country B buys a permit from country A, it will earn £30; it pays £120 for the permit but it can increase its emissions by one unit and reduce the costs by £150. Country A earns £20; it receives £120 through the sale of the permit, and incurs an abatement cost of £100 by reducing the emissions by one unit.

If many countries participate in the CO_2 agreement and each country is relatively small, a competitive market for CO_2 emissions permits is likely to develop. Each country will regard the price of a permit as independent of its emissions. It will buy permits as long as the marginal cost of emissions reductions is higher than the permit price, or it will sell permits if the permit price is higher than this cost. Eventually, all marginal costs of emissions reductions will be equal and similar to the permit price. Thus, a property of a tradeable CO_2 permit system is that it will be cost-effective if all of the countries signing the agreement are relatively small.

As stated, one advantage of a tradeable permit system is that it separates the efficiency and justice considerations. Under the assumptions of a competitive market, cost-effectiveness will result from trade regardless of how the permits are initially distributed. Independent of the allocation rule, the countries will adjust their emissions such that the marginal cost of emission reductions are equal. The allocation rule then just determines the transfers among the countries.

The Distribution of Permits

It is important to clarify the concept of distribution in an analysis of a tradeable CO_2 permit system. *Distribution* can be defined as an act or as a state. Some goods can be distributed directly by an act (e.g., money) and the distribution may be called a *direct distribution*.[4] For goods which cannot be directly distributed (e.g., utility), the distribution can be influenced by the distributions of other goods *(indirect distribution)*. A third category of goods can be distributed neither directly nor indirectly (e.g., talent).

The distribution of tradeable permits may be classified both as a direct and an indirect distribution problem. It is a direct distribution of rights and assets, as well as an indirect distribution of welfare, utility, or opportunities to the different signatories of the agreement.

A CO_2 emission permit is a right to emit one unit of CO_2, and hence, a right to increase the atmospheric concentration and thus, the effects of global warming. The atmosphere is an example of a global common property resource. Therefore, the use of the waste capacity of the atmosphere is use of common property, and the control of the *right to pollute* is the control of this use. In general, the unregulated use of global commons may lead to a non-optimal solution for the global society (see Hardin 1968). Therefore, the community has a strong interest in enforcing limitations of this use (see also Young 1990).

It is assumed that the emission permits will be traded in a market at a defined market price. Under the assumption of perfect competition, there will exist only one price which is equal to the common marginal cost of emissions reductions. Thus, the permits can be considered as *assets.*

The revenue from trading the assets, and therefore, the direct distribution of permits, has impacts on for example *welfare, utility or opportunities for development* in the different countries. For example consider the impacts on the welfare of a country, using an ordinary welfare function. Welfare is a good which can be distributed in an indirect way. This means that the distribution of welfare is influenced by a direct distribution of goods which are inputs in the welfare function. Usually, the welfare of a society is assumed to be positively correlated with income (for instance, the gross domestic product [GDP]). Energy is an essential input in the economic processes that create goods for final demand, and as such, it is essential in income determination. As CO_2 emissions can be estimated from energy use by emission coefficients, income, and thus, welfare can be expressed as a function of CO_2 emissions (see Kverndokk 1993).

Introducing tradeable CO_2 permits allows a perfect separation of welfare and the CO_2 reduction level for a country. Cost-effectiveness, which is an implication of the system, gives a certain distribution of income. However, the net sale of permits at the market price must be added to income. Hence, as long as welfare is increasing in income, a large number of initially distributed permits will increase the welfare of a country. This is because the actual number of permits

demanded by a country is independent of the number of permits distributed. Under such a regime, the initial distribution of permits is similar to a lump-sum distribution of revenue.

The importance of the net sale of permits can be illustrated with simulation results from Kverndokk (1993). In that study, implications of a tradeable permit regime are analysed under different allocation rules where the global CO_2 emissions constraint is set to 80% of its 1990 level. Table 1 gives the cost-effective emissions reductions under this agreement for the different world regions USA, other OECD countries (OOECD), the countries of the former Soviet Union and Eastern Europe (SU-EE), China, and the rest of the world (ROW). As stated, the cost-effective emissions reductions are independent of the permit allocation rule. Under this agreement, the highest emissions reductions are made by the developed countries. China's emissions remain almost constant, and the other developing countries (ROW) could even increase their emissions in the first half of the next century.

	USA	OOECD	SU-EE	CHINA	ROW	TOTAL WORLD
2000	30	21	12	1	29	20
2020	38	50	35	4	-54	20
2050	46	49	13	2	-28	20

TABLE 1
Cost-effective Reductions of CO_2 Emissions compared to 1990 levels, per cent
(Source: Kverndokk 1993)

The transfers between countries due to the trade of permits are considerable under this agreement. When the initial distribution of permits is proportional to 1990 population, the transfers from the United States and the other OECD countries to the developing world would represent 6% and 3% of the respective region's potential GDP in 2000. These transfers are much higher than the development assistance disbursement target of 0.7% of GDP established by the United Nations (UN), a target still not met by most industrialised countries. However, if the permits were initially distributed according to GDP in 1990, the developing countries would be net importers of permits, and in 2000, China would have to transfer about 50% of its potential GDP, an amount similar to its GDP in 1990, to the developed world.

The Relevance of Justice Theories

The purpose of a theory of justice is to evaluate a certain distribution (as a state) and/or suggest a certain distribution (as an act or a state). For the permit distribution problem, such a theory will suggest a distribution of goods which can be distributed directly and indirectly. However, the choice of a suitable theory depends on the characteristics of the distribution problem. As a starting point, it is useful to clarify the contrasting concepts of local and global justice. According to Elster (1991a), a *local justice* problem is characterised by decentralised decisions, where the distribution is not contingent on compensation and the distribution consists of goods other than money. In contrast, *global justice* problems, or globally redistributive policies, are centrally designed, intended to compensate people for various sorts of bad luck, and typically take the form of cash transfers. The study of local justice is the normative study of how institutions allocate their scarce resources. Justice is local if the institutional distribution cannot be derived from a comprehensive redistributive scheme of society-wide or global justice, where global in this context does not necessarily mean international.[5] The spheres of society where justice is local obey autonomous normative allocation rules, which means that the rules that are chosen are independent of decisions made in other spheres of society. As a matter of fact, most institutional decisions are actually taken at an autonomous and separate level.

It is relevant to discuss whether the distribution of permits should be analysed as a local or global justice problem. That is, should the distribution help to offset poverty, reduce the gap between industrialised and developing countries, compensate for lack of other goods, or should it be considered independently of other problems?

According to the definitions of local and global justice problems, this distributive problem seems to be classified as a global one. The question of compensation is relevant (see below) and distributing permits can be considered a lump-sum distribution similar to a distribution of money. However, permit distribution as the only means to create global justice seems unreasonable. Global justice, the 'solution' to a global justice theory, can only be achieved if the central institutions in a society follow certain principles of justice which involve the distribution of several goods.

To conclude, the permit distribution is not a local autonomous distribution problem, its character is rather global. But it cannot be used as the only means to implement global justice. As a result, no philosophical global justice theory alone may guide us in solving this distributive justice problem, but theories of global justice may help us in analysing it.

PRINCIPLES OF JUSTICE

In this article I distinguish between equity and justice principles. *Equity principles* are defined as normative criteria for how a society should be organised, how goods or burdens should be distributed, etc. (see e.g., Rose 1990). On the other hand, *principles of justice* are basic rules underlying theories of justice. Thus, they can be interpreted as side constraints to these theories. Several principles of justice may be in accordance with one equity principle, and vice versa.

Several global theories of justice (for example, utilitarianism, and the theories of Rawls and Nozick) give different equity principles for the distribution of goods and rights.[6] Moreover, intuitions about particular cases may be compatible with more than one theory of justice. However, as previously argued, no single global justice theory may guide us in solving our distributive justice problem. Thus, instead of discussing the most appropriate theory of justice or the 'best' equity criterion, one approach is to use common denominators in theories of distributive justice. Two metaprinciples, which are principles implicit in all global theories of justice, are claimed to be *ethical individualism* and *ethical presentism* (see Elster 1991b, 1992; the concepts are defined below). In addition to the two metaprinciples, a principle of *avoiding distributions based on moral arbitrariness* also has widespread support in the development of global theories of justice.

An analysis using these principles of justice requires a list of competing allocation rules, since the force of these principles is exclusionary rather than determinative, i.e., we can say which rules from a given list violate the principles, but we cannot determine the 'best' allocation rule by just employing the principles. The weakness of this type of analysis is that the conclusion depends on which allocation rules are included on the list. Therefore, the list should be extensive.

For a tradeable permit system to be attractive and to leave little scope for objections from individual countries, it is important that the system is outlined in a *simple way* or the initial distribution follows a simple allocation rule. In the literature (e.g., Grubb 1989, Pearce 1990, Young 1990 and Cline 1992), the following simple allocation rules have been suggested:[7]

(1) A distribution proportional to current CO_2 emissions.

(2) A distribution inversely proportional to accumulated CO_2 emissions.

(3) A distribution proportional to GDP or 'real' GDP, i.e., GDP adjusted by purchasing power parities.

(4) A distribution proportional to land area.

(5) A distribution proportional to population.[8]

Ethical Individualism

The view of *ethical individualism* (EI) is that justice is attached to individual human beings. It is a denial of supra-individual and non-human justice. The first treating groups, and the latter organic or inorganic nature as subjects of justice. There are two claims of EI: Theories of justice should (i) allocate goods among individuals, and (ii) this allocation should be made on the basis of information about individuals (Elster 1991b, p. 1).

The first claim of EI is prima facie violated under an international agreement since the signatories are countries; the permits are distributed among countries. However, by assuming that each country distributes the income from permits among its citizens, the claim is satisfied. This is because of the separation of the resource distribution between countries and individuals.[9] All allocation rules will at first sight be compatible with the second claim of EI. The first four allocation rules are distributions based on average measures (the GDP rule distributes for example permits to each country according to GDP/pop. x pop., which means that population is taken into account), and the last allocation rule means an equal per capita distribution of permits.

In general, a ranking of societies based on average measures (for each society) will be compatible with EI, while a ranking of societies based on, for instance, a comparison of average income for different groups within a society will violate EI. This can be explained by establishing a function $F(\mathbf{v}_S)$ which ranks societies, S, according to justice. EI states that only information about individuals can enter as inputs, **v**, in the function. Assume that the function is based on the income of groups of individuals. Then assume that the individuals are regrouped such that the average income in some groups changed, while each individual's income remained the same. If this regrouping changes the value of the function, then EI is violated. That is, the ranking of justice has changed, but the individuals' situations are unchanged.

In the strict interpretation, EI seems to be a rather coarse-grained or indeterminate principle. It is, for instance, possible to defend a group-based theory by arguing that the distribution of goods across individuals will determine how it is distributed across groups. Thus, even a group-based theory may permit the justice evaluation of a distribution across individuals. Information about individuals is the basis for information about aggregates. A theory using aggregates is based on information about individuals and can, therefore, be compatible with EI.

Another critique of the strict interpretation of EI is that the real crux of this metaprinciple is that individuals are given the same rights, claims, and care. Hence, it is important to consider the impacts on individuals under the enactment of different allocation rules, and one needs to determine how to best represent the individuals' situations in the theory. It can be argued that a distribution based on group averages yields the best representation of the individuals' interests.

One answer to the critique is that 'EI requires theories of justice to be concerned with individuals *in an essential way*' (Elster 1991b, p. 4, his italics). Essential information about individuals, or alternatively that information about individuals should be used in an essential way, should therefore, be a claim, even if the rule, prima facie, is compatible to EI.

A discussion of *essential information* promotes a consideration of morally relevant information. While I discuss this in more detail below, here I only consider the weaker claim that the number of people living in a country should matter. Consider a distribution proportional to land area. That is a distribution to different countries on the basis of land area per capita times the population. This could be interpreted as being compatible with EI. However, there is no direct proportionality between a country's land area and its population. Even if the land area is the sum of land area per capita across the individuals, land area is constant, and we do not need possess information about the individuals to calculate it. If we do not consider the Antarctic which accounts for 10% of the total land area, the former USSR, Canada, Brazil, Australia, and Greenland account for more than 40% of the remaining area, while representing less than 10% of the population and only 20% of current global CO_2 emissions (see Grubb 1989, p. 36). According to this, it can be argued that land area per capita does not incorporate essential information about individuals in this distribution problem.[10] The same argument can be used if GDP and therefore, also CO_2 emissions (as most CO_2 emissions are connected to GDP producing activities), is mainly based on a rent from natural resources. For example, Saudi Arabia's and Kuwait's GDPs (and CO_2 emissions) are relatively independent of their populations.

To conclude, the allocation rules based on land area, GDP and CO_2 emissions (current and accumulated) may under certain conditions be excluded on the grounds that they violate EI. These conditions may not be satisfied, and for a further exclusion we need to analyse other principles of justice.

Ethical Presentism

The basis of *ethical presentism* (EP) is '... that past practices are irrelevant to distribution in the present, except to the extent that they have left morally relevant and causally efficacious traces in the present' (Elster 1991b, p. 14). A few examples may clarify this metaprinciple. First, no one should have to suffer from crimes committed by his or her parents; one cannot choose one's parents. Nevertheless, if people are worse off today than they otherwise would have been because of discrimination against their parents, a claim for compensation is compatible with EP. Compensation does not follow from EP, since metaprinciples are only constraints in a justice evaluation. However, you cannot claim to discriminate against somebody today on the grounds that your parents were discriminated against in the past. A general morally accepted principle is that

nobody can claim stolen wealth left in a will from his parents.[11] Inheritance is, however, compatible, but not an implication of EP as long as the inherited wealth has been legally and fair acquired.

If an allocation rule gives advantages to countries based on their present superior position that has been achieved by these countries' past discrimination and exploitation of other countries, then EP is violated. On the other hand, if the countries' present superior position has been achieved because they have previously used their resources more efficiently than other countries, EP may not be violated. This is because a distribution that is based on legal inheritance is compatible with EP. One main difference between these two cases is that in the first case the worse-off countries can claim compensation and they cannot in the second one.

One argument in the greenhouse policy debate is that 'the bucket is full', mainly filled up by the developed West,[12] and that they have a moral obligation to 'clean it up'. Industrialised countries have reached a high level of development partially because they have exploited resources and the environment. Following this argument, it would not be 'fair' for the developing countries to have to restrict their consumption of energy sources, such as fossil fuels because it may reduce these countries' possibilities of obtaining higher standards of living. Therefore, compensation to developing countries from industrialised countries may be suggested. Such compensation is in the same line as the Polluter Pays Principle, a principle established by the OECD for resolving environmental conflicts. A natural means for the compensation is the distribution of tradeable permits and a distribution based on accumulated CO_2 emissions is relevant since compensation is due to past practices.

The question of compensation is, however, complicated. As argued by Young (1990) and Grubb et al. (1992), emissions of CO_2 in the past have created positive externalities; not only the emitting countries have benefited from the combustion of fossil fuels. One example is the industrial revolution. It created large emissions in Great Britain in the beginning of last century, but also had a major impact on the development of most other regions. Since the global economy has been based on the free disposal of CO_2 emissions, and the benefits were not only limited to the emitting countries, the argument that the developed world is totally liable for past emissions, and that these emissions only harmed developing countries, is hard to support. This discussion does not, however, rule out every compensation argument.

Other relevant allocation rules to analyse under EP are distributions based on current CO_2 emissions and GDP. As mentioned, most CO_2 emissions are connected to GDP producing activities. Therefore, I only consider GDP. The crucial question is then whether GDP is only a function of the present situation. If GDP is a function of the present situation, then a distribution proportional to GDP (or alternatively to CO_2 emissions) does not violate EP. However, it is hard to argue that current CO_2 emissions and GDP are independent of the past, or of events beyond the influence of the current world population.

If the GDP (or current CO_2 emissions) is dependent on the past, countries' present economic and social positions are, at least partially, attributable to their inheritances. If the present superior position of some countries is the result of these countries' exploitation of other countries in the past, then the GDP and CO_2 allocation rules are not compatible with EP. However, if the countries' present superior position is not a result of past exploitation, then the implementation of these rules would not violate EP.

In summary, none of the remaining allocation rules can be clearly excluded on grounds of EP, but the rules based on GDP, and current and accumulated CO_2 emissions can be excluded under certain conditions.

Moral Relevance

An arbitrary rule giving redheads a salary increase could be compatible with EI and EP when they are strictly interpreted. However, red hair will not be defined *morally relevant* as a distribution criterion in most theories of justice. Moral relevance is not a simple concept. Nevertheless, there seems to be a widespread understanding that a distribution of goods should not be based on *morally arbitrary* components.[13] Thus, the problem is restated as a principle of avoiding moral arbitrariness. A definition of this concept is then required.

Two elements are often claimed to contribute to the material advancement of societies (see Beitz 1985, pp. 288-289), one is the human co-operative activity, and the other is called the natural component. While the first element refers to the human component of material advancement – in itself the subject of theories of justice – the second element is components present on the earth's surface which are not due to human production. One example of this is natural resources or assets. *Natural assets* are arbitrarily distributed on the earth's surface and are compared in the literature (see Beitz 1985 and Pogge 1989) to the distribution of *natural endowments*. These are defined as such contingencies which are inescapable and present from birth, and may contribute to material advancement because of the implications for human cooperative activity. Examples are nationality, genetic endowments, race, gender and social class. According to Rawls (1971), p. 102, natural endowments are 'neither just or unjust; nor is it unjust that men are born into society at any particular position. These are simply natural facts. What is just or unjust is the way that institutions deal with these facts.' The distribution of natural assets and endowments are, in general, assumed to be morally arbitrary and unacceptable as standards for distribution, since they are beyond the control of human beings. Nobody should have to suffer from the pain of inequality due to morally arbitrary factors, if the sacrifices cannot be shown to advance equality in other or more important fields. Natural endowments may, however, be relevant for distribution in problems like who shall do military service, or who shall be members of the South African Parliament. Thus, the reasons for using morally arbitrary factors as basis for a distribution may be to

eliminate existing inequalities or to distribute necessary burdens to those who best can handle them.

In the discussion of EI, I initially assumed that morally arbitrary components were non-essential information in this distributive problem. This is relevant for three main reasons. First, as stated, *land area is* a natural component. Hence, land area should not be used as a standard for distributing permits if it cannot be proven that this allocation rule actually eliminates existing inequalities. For example, people living in large areas may need more resources to meet their transportation needs than people living in densely populated and smaller areas, in order to attain the same standard of living.

Continuing my analysis of EP, inheritance may be defined as a morally arbitrary component. Assume that a country's present economic situation is dependent on the past. Thus, even if the better position cannot be claimed to the result of past exploitation and discrimination, a distribution based on *GDP* (or CO_2 emissions) can be rejected by reason of moral arbitrariness. Such a distribution would give disadvantages to people already suffering from inequalities on morally arbitrary reasons.

Nationality is a natural endowment. People cannot choose their nationality, at least not at birth. An allocation rule giving preference to one nationality compared to others can only be advocated if there are morally relevant characteristics of all individuals of the nationality which are not present for any individuals of other nationalities. Given that there are no such relevant characteristics for this distribution problem, the only way of avoiding a morally arbitrary distribution is a distribution of permits proportional to population.

To conclude from the analyses of justice principles, a *distribution of permits proportional to population* appears to be the only rule from the list of alternative allocation rules that is in accordance with all three principles of justice: Ethical individualism, ethical presentism, and the principle of avoiding morally arbitrary components. Thus, the next step will be discussing the different arguments against this allocation rule.

ARGUMENTS AGAINST AN EQUAL PER CAPITA DISTRIBUTION

In most theories of justice (important exceptions are utilitarianism and Nozick's theory) *equality* is the baseline. The task of the theories can then be stated as justifying deviations from equality; the burden lies on those who argue for an unequal distribution. There are several reasons to deviate from equal distributions (see Elster 1992, chapter 6), and some of them are relevant for my proposal of an equal per capita distribution.

(i) An unequal distribution of a good is justified if one is only concerned about the *distribution of another good*. In our problem, it could be argued that the distribution of welfare is the most important concern. A more equal welfare

distribution could imply that an even larger share of permits should be distributed to less industrialised countries than under a distribution proportional to population. Thus, if the permit allocation rule was the only means of inducing an equal welfare distribution, a distribution proportional to population would probably not suffice. However, as argued, the distribution of permits should not be the only means to achieve an equal welfare distribution. Other means could include reducing other environmental problems, solving the debt crisis, and increasing development assistance disbursement.

(ii) *Compensation* is also an argument for an unequal distribution of permits. As discussed, compensation from industrialised countries to developing countries could be advocated even if there are theoretical arguments against it. A distribution proportional to population will induce large transfers from industrialised to developing countries, and though it is not compensation, it has the same effect.[14]

Different allocation rules may create *different incentive effects* among the signatories of the international agreement. Incentives could be either desirable or undesirable. The aim is to create the right incentives, and avoid the undesirable ones. Some incentive problems could be:

(iii) A distribution proportional to population would lead to a significant transfer from the developed to the developing world. This may have the same effect as development aid. Good intentions do not always create the desirable consequences. It is sometimes argued that aid harms its recipients by reducing local incentives *to find permanent solutions* to their problems. However, rules leading to transfers from developing to industrialised countries (for instance, rules based on GDP or current CO_2 emissions) would probably reduce the possibility of solving problems in the former countries.

(iv) A distribution based on population could also give incentives for countries to *increase their populations*. Even if an increased population can be viewed positively in some industrialised countries, for the world, especially for the developing world, it may increase environmental problems and poverty. Proposals to modify this incentive include distributing permits according to the adult population, the population in a base year, or some 'projected population under maximum population control effort' over time (see Grubb 1989 and Cline 1992).

While the above problems may be solved, there are several other important issues that may be more difficult to untangle.

(v) The separability of efficiency and justice under the tradeable permit system is based on the assumption of *perfect competition*. If this assumption is violated, there may be monopolistic or oligopolistic behaviour in the market. Cline (1992), p. 352, discusses the possibilities of monopolising the market (on the supply side) under the population allocation rule.[15] He concludes that a cartel action to obtain monopoly rent would 'be considerably less feasible than the only modestly successful past efforts of OPEC to sustain rents from international

trade in oil'. Other imperfections could lead to the hoarding of permits. Developing countries may be unwilling to sell their excess permits due to prospective population growth. This problem could be avoided by distributing the permits on an annual basis or through leasing systems for permits. One problem with an annual distribution is that countries would tend to overshoot their emissions targets (see Hoel 1991, p. 106). However, it will be difficult to determine the effects of the different allocation rules under different imperfections.

(vi) The essential problem in the development of an international CO_2 agreement is to make the agreement substantial. This is to agree upon a significant reduction by including many countries in the agreement. The matter of concern is then whether a permit distribution proportional to population, which is the rule advocated by principles of justice, is *politically feasible.* This is discussed in the next section.

JUSTICE AND POLITICAL FEASIBILITY

A distribution of permits that is proportional to population may not be the easiest rule to implement, or even worse, it may not be politically acceptable. Justice and political feasibility may be opposed. First, a voluntary agreement does not always carry moral weight because of unfair background conditions. Second, there may be constraints on the bargaining side which make justice difficult.

Unfair Background Conditions

A basic principle from bargaining theory is that the players (or parties) will only reach a voluntary agreement if it makes them better off compared to status quo (Pareto improvement). However, even if this principle is fulfilled, the agreement is not necessarily just. This is supported by the theories of Rawls (1971) and Nozick (1974). According to Rawls' theory, 'interpersonal agreements can carry moral weight only if they are freely entered into under conditions that are fair' (Pogge 1989, p. 248). *Background justice* is not preserved when some participants' basic rights, opportunities, or economic positions are grossly inferior. An agreement is only morally appealing if the differences in bargaining powers do not exceed certain limits. Agreements that are not based on a certain background justice may make the society even more unjust. Examples can be on an individual level such as an agreement between a prostitute and her customer, or a poor farmer in Bangladesh selling one of his kidneys to a rich American; the farmer may be able to buy land while the American may live a few years longer. On a non-individual basis, there are examples from international trade as when coffee or even narcotics producing crops are substituted for food crops used to meet

local demand in poor countries. This may increase food prices and result in the starvation of the poorest.

According to Nozick, a distribution is just only if it is the end result of an unbroken chain of just transfers that has begun with a just original appropriation. History counts rather than end state. If history is just, the principle of *justice in transfer* states that an agreement is just if both parties prefer the agreement to no agreement, given that none of them use their power to make the status quo or the non-agreement state worse for the other party than it would have been otherwise. Although the theories of Rawls and Nozick differ in many ways, one interpretation of both theories is that an agreement could be rejected as just if power and resources are very unequally distributed.

An analysis of differences in bargaining power seems to be important for studying the moral weight of a CO_2 agreement. *Bargaining power* can be defined as the relative ability or possibility to influence the contents of an agreement. This ability could be attributed the exertion of credible threats (or threats that are believed to be credible), higher self esteem, greater authority, superior knowledge, etc. Although a study of bargaining power needs a more precise definition, some remarks can be made on credible threats. Focus on some of the differences between developed countries (DCs) and less developed countries (LDCs). In general, DCs control most of the world's capital and military power which may be important for a credible threat of *sanctions.* DCs are also responsible for the majority of the world's current CO_2 emissions. Hence, if the *threat of global warming* is critical to LDCs, it is very important for them to include DCs in an agreement. However, compared to the rest of the world, the relative annual CO_2 emissions from DCs have been decreasing during the past decades. Furthermore, according to most energy scenarios, energy consumption in LDCs will increase rapidly in the future (see, e.g., Sathaye and Ketoff 1991). Most of the energy reserves in highly populated LDCs such as China are coal, which is the most polluting fossil fuel when it comes to CO_2 emissions. Thus, it may be important for DCs to include some of the large LDCs in an agreement if they fear the threat of global warming. To conclude, it is reasonable to believe that the difference in the DCs and LDCs bargaining power, at least with respect to credible threats, may not be too large. It is also reasonable to assume that the LDCs bargaining power may even increase in the future due to high prospective emissions. From this view, there may be possible to make an agreement that carries moral weight.

Constraints

In general, institutions meet several constraints when distributing scarce goods. Such constraints could be due to undesirable incentive effects, directions from political authorities and rules for bargaining. Since I have previously discussed *incentive effects*, I now will concentrate on the latter two constraints.

Directions from political authorities are probably more relevant for national local justice problems than for international bargaining. Apart from the UN, there are no international institutions which could place political constraints on global bargaining. Nevertheless, the UN has no power or jurisdiction to carry out the constraints. However, a few points should be made about *politically acceptable transfers*. It is difficult to believe that large transfers from industrialised to developing countries would be politically acceptable, especially in light of the experience from the UN's development assistance disbursement target. This would imply that a distribution that is proportional to current CO_2 emissions, or a combined allocation rule of, for example, CO_2 emissions and population would be more acceptable since these rules induce the least transfers (see Kverndokk 1993).

Politically or legally established *rules for bargaining* may be more important than directions from political authorities. As stated, *simplicity* may be one such rule. Due to the significance of global warming, another rule must be *wide participation*. As a consequence, the interests of the nation with the least concern for the greenhouse problem would be important for shaping an agreement. For example, the United States accounts for about 25% of current CO_2 emissions from fossil fuels. Hence, it is important to include the United States in the agreement. However, this country has been rather reluctant to commit itself to binding agreements on emissions reductions. Therefore, the interests of the United States are very important for shaping an agreement. It is questionable whether they would accept an allocation rule based purely on population because of the large transfers implied by this rule. The *precedents* established in analogous cases are crucial for any bargaining solution. However, global warming has no close precedents. International environmental agreements on reducing CFCs and sulphur emissions are far more limited in scope, involve fewer uncertainties, probably have less economic and environmental consequences, and are easier to solve with currently available technologies. Nevertheless, the tradition of international environmental agreements could play an important role. For example, a distribution proportional to current CO_2 emissions equals a uniform percentage emissions reduction initially. This is a principle which has applied to international environmental agreements. Other precedents may also be important. Land area has also been used as a basis in distributive issues, such as in the regulation of oceanic resources. On the other hand, a principle of prescriptive rights to the atmosphere could imply a distribution based on CO_2 emissions. There may also be a need for an *urgent agreement*. This need may lower the priority of justice arguments in negotiations. The last argument concerns a bargaining situation where an attempt is made to solve *several* environmental or distributional problems at the same time (a comprehensive approach). In this situation, it would be difficult to determine how the outcome of a justice evaluation would affect the allocation rule for CO_2 permits.

CONCLUSIONS

In this article I have discussed the initial distribution of tradeable CO_2 emission permits as an intragenerational distributive justice problem. According to the principles of ethical individualism, ethical presentism, and avoiding morally arbitrary components as basis for distribution, an allocation rule based on population is recommended. However, for issues of distributive justice, there is no unanimous answer. Even if the parties in international CO_2 negotiations agree on the principles of justice presented in this article, other allocation rules may be advocated due to the reasons discussed. Ethical intuitions may also differ. People from different cultures may not agree on what is just or unjust due, for instance, to religion and tradition. Intuitions about justice may also be influenced by self-interest; the equity principle chosen by an individual may be dependent on the consequences for herself. Therefore, it is unrealistic to believe that the parties would agree on one of the allocation rules specified in this article.

Even if the population allocation rule appears to be politically unacceptable today, the strong arguments for this rule could become more persuasive in the future. The UN Framework Convention on Climate Change, now signed by over 160 countries, was a first step in this direction. It states as the final aim the stabilisation of greenhouse gas concentrations 'at a level that would prevent dangerous anthropogenic interference with the climate system' and this 'within a time frame sufficient to allow ecosystems to adapt naturally to climate change' (Article 2).[16] However, the Convention addresses the industrialised countries, and the developing countries are not committed to do anything unless the industrialised countries pay for it. In addition, equity is established as a guiding principle for the Convention. An allocation rule based on equal per capita permits satisfies this principle, and involves transfers from the industrialised to the developing world to help them to meet the full costs of CO_2 mitigation. There may also be possibilities to implement this allocation rule in combination with other rules, and let the distribution shift towards the population criterion over time. This view is advocated by studies which claim to take 'realism' into account (see Young 1990, Hoel 1991, Cline 1992 and Grubb et al. 1992).

NOTES

I am grateful to Kjell Arne Brekke, Samuel Fankhauser, Andreas Føllesdal, Rolf Golombek, Cathrine Hagem, Michael Hoel, David Pearce, Per Sandberg and Bjørn Sandvik for comments on earlier versions, and to Jon Elster, Aanund Hylland and Tore Lindholm for valuable discussion. I would also like to thank Sarita Bartlett and Hege Eliassen for editing assistance. The article was financed by The Norwegian Research Council for Applied Social Science, and is a part of the SAMMEN project at Foundation of Research in Economics and Business Administration (SNF), Oslo.

[1] The discussion is also relevant for an international carbon tax system where the total tax

income has to be reimbursed to the signatories of the agreement according to some predeterminated reimbursement parameters (see, e.g., Hoel 1991). These parameters can be set according to the same allocation rules as tradeable emission permits.

[2] Separability of intergenerational and intragenerational justice is a usual assumption in analyses of justice. However there are problems with this assumption. As an illustration, consider the concept of sustainable development. The Brundtland Report argues that 'Even the narrow notion of physical sustainability implies a concern for social equity between generations, a concern that must logically be extended to equity within each generation' (World Commission on Environment and Development 1987, p 43). However, I assume that the aspect of sustainable development connected to global warming is incorporated into the determination of a total emission reduction rate, a rate which is not affected by the initial distribution of permits.

[3] Also see Hoel (1991) for an introduction to cost-effectiveness and tradeable CO_2 permits.

[4] 'Goods', in this context, is used in a wider way than what is usual in economics.

[5] Examples of local justice problems are who shall do military service, who shall receive organs for transplantation, etc., while income distribution and wage determination enter into the global redistributive system and may therefore be classified as global justice problems.

[6] Studies of different international equity criteria applied to the global warming problem (see Rose 1990, 1992), give no unique allocation rule for permits. One equity criterion can have more than one allocation rule and one allocation rule can be consistent with more than one criterion.

[7] Linear combinations of these rules are of course also possible. It is, however, more appropriate to analyse them separately.

[8] This is equivalent to sharing the global emissions total equally among all individuals in the world.

[9] Young (1990), argues that even if nations are the repositories of emission permits, individuals should be regarded the primary claimants to emission entitlements since they would suffer from the potential global warming, benefit from reducing the risk of it and also from activities and products increasing this risk.

[10] This allocation rule could, however, be advocated by referring to the consequences to individuals. Living in a rural area may require more resources than living in a densely populated and smaller area. Distributing the resources according to land area could, therefore, reduce inequality.

[11] The problem is more complex if the wealth was stolen by ancestors several centuries ago. Examples of this can be both on an individual and group level. For example in Australia it is not generally accepted that Europeans have no moral right to land ownership. It is, however, generally accepted that the transfers of control of land from the Aboriginals to Europeans were not voluntary. In the distributive problem analysed in this article, however, it is claimed that a distribution based on stolen inheritance is unjust and violates EP. This is also in accordance with Nozick (1974).

[12] The bulk of the greenhouse problem has been recently created by industrialised countries (see Halvorsen et al. 1989 and Fujii 1990).

[13] One exception is the first chain in the theory of Nozick (1974), i.e., the original appropriation, which is essentially a 'finder's keepers' principle. Under this principle, the distribution of goods is often argued to be morally arbitrary.

[14] A distribution proportional to population gives each individual an equal right to emit in the future, while compensation is based on previous events.
[15] This problem is avoided by using carbon taxes and not tradeable emission permits. The reimbursement of the total tax revenue can still be in proportion to population, i.e. the risk of monopolisation is a problem of permits in general, and it is not caused by the allocation rule.
[16] For a summary and assessment of the Climate Convention, as well as the other agreements signed at the 1992 Earth Summit in Rio de Janeiro, see Grubb et al. (1993).

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