

Fair Compromise in a Morally Complex World*

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A fair amount of thought has gone into analysing the perplexing and thorny issues of equity brought about by changes in global climate. Many insightful studies have been published, not least 'The Complex Elements of Global Fairness' by Eileen Claussen and Lisa McNeilly.¹ Following their lead, the subject of this note is the moral complexity of climate change – or rather, how to deal with it in a fair and constructive manner.

Anyone vaguely familiar with the multilateral climate negotiations will be aware of one specific equity dispute: the question of how to allocate emission quotas ('assigned amounts') to the Parties of the UN Framework Convention on Climate Change. While at Kyoto a consensus did emerge on how *reduction* targets should be distributed amongst industrialised countries – namely at roughly the same percentage relative to their 1990 emission levels² – there is no agreement as to what a fair world wide distribution of quotas would or should be. Apart from 'Grandfathering' – implicitly espoused by many industrialised country voices who phrase the problem in terms of adopting '(meaningful) emission *reduction* targets' (Box 1) – the alternative most often cited is an allocation in proportion to population size ('Per Capita'). In Section II of this note, these two antithetical positions are used to illustrate the 'Preference Score' method which, as it were, 'synthesises' incompatible proposals in certain morally complex situations into a fair compromise solution.

To supplement prior accounts of this method,³ this note will focus on what might be called the 'wrongful dismissal' of equity-based distribution proposals, i.e. a rejection to consider proposals even though they can justifiably be argued for on grounds of equity. This is an issue which in my previous discussions did not feature as prominently as it deserves in light of its potential – discussed in Section II – to undermine the Preference Score compromise procedure. Thus Section I – introducing the core concept of a 'morally ambiguous' distribution problem – involves an illustrative example which makes it possible to expose, in particular, a potential misconception about Per Capita and Grandfathering: the view that they are in an essential way linked to certain rungs on the welfare ladder – Per Capita with being poor, Grandfathering with being rich. This misconception is not only wrong, but can easily be misused to argue against either of these proposals as reflecting nothing but greed: the rich advocating Grandfathering because they want 'to keep their spoils from the poor,' the poor espousing the Per Capita solution because they want 'to take it away from the rich.' Dismissing either of them on such misconceived grounds would not be justifiable.

The allocation of assigned amounts itself has given rise to a general conceptual dispute which also warrants some analytical comment in light of the potential for such 'wrongful dismissals.' As it happens, both Per Capita and Grandfathering of assigned amounts can be justified as equitable solutions to a resource allocation problem.⁴ But even though it is clear

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¹ Pew Center on Global Climate Change, Washington D.C., 29 October 1998.

² Three quarters of the targeted Parties ending up with a quota of 7 (±1) per cent below their 1990 emissions.

³ Having originally introduced the method in *Justice in Global Warming Negotiations: How to Obtain a Procedurally Fair Compromise* (Oxford: OIES, 1998, second, revised ed. 1999), it was expanded on in *Fossil Fuels in a Changing Climate*, (U. Bartsch and B. Müller, Oxford: Oxford University Press, 2000), and in my 'Varieties of Distributive Justice in Climate Change: An Editorial Comment' (*Climatic Change*, 48: 273–288, 2001).

⁴ For more on this see, in particular, Müller (1999).

Box 1: The ‘Grandfathering Family’

‘Grandfathering,’ in the context of allocating assigned amounts, refers to an allocation in proportion to a historic emission baseline. As such it can be conceived as a distribution of a resource according to historic entitlements, justified for example, in terms of ‘just acquisitions’ or ‘needs’. Grandfathered assigned amounts are tantamount to a uniform percentage change relative to this historic baseline (e.g. ‘1990 – 7%’). A ‘sister’ distribution to grandfathering is that given in terms of uniform percentage reduction from some ‘Business-as-Usual’ emission projections for the relevant commitment period (e.g. ‘2020 – 15%’). It may be justifiable in terms of equal mitigation burdens in a context of equal causal responsibilities. And then there are ‘cousins’ – such as emission intensity based proposals (see Section III) – which allocate assigned amounts in proportion to a emission baseline modified by some other parameter, some of them less open about their roots than others: a recent MIT study, for example, included a proposal to ‘equalize reductions per capita across all countries’* which – while only sporting a ‘per capita’ label – upon inspection turns out to have shares roughly proportional to BaU emissions (additively modified by: – population share % reduction percentage).

* M. J. Babiker and Richard S. Eckhaus, ‘Rethinking the Kyoto Emission Targets’ MIT Global Change Report. 65, 2000.

that any future mitigation regime will face the problem of allocating *assigned amounts*,⁵ no consensus has as yet emerged on whether this problem can or should be interpreted in terms of allocating (the use of) a *natural resource*, or not. Alternatives to the ‘resource interpretation’ have been proposed, largely involving references to certain performance indicators, such as the greenhouse gas (GHG) emission intensity of the economy – characteristically measured by emissions per unit of gross domestic product.

As resource allocations, Grandfathering and Per Capita differ primarily in their view of the *status quo ante*: ‘Were there, or were there not, prior resource entitlements?’ Yet there is another, more general difference: whether they remain justifiable if the interpretation of assigned amounts as a resource is rejected. Indeed, the most serious consequence of such a rejection, I fear, would be the elimination of the Per Capita allocation of assigned amounts as an equity-based proposal. Grandfathering – or one of its close relatives (Box 1) – by contrast can survive such a rejection. It can be argued for in terms other than allocating a resource. Since a Per Capita allocation does not seem to have any obvious ‘relatives’ of this kind, the resource interpretation issue is likely to have far more than merely semantic consequences. In light of this, Section III of this note is used to put forward a defence of assigned amounts as a natural resource and, in the process, to examine the consequences of some of the envisaged emission intensity alternatives.

⁵ If the regime is to include the sort of flexibility mechanisms envisaged under the Kyoto Protocol, then it is difficult to see how an allocation of assigned amounts measured in absolute magnitudes – such as ‘tons of carbon dioxide equivalent (tCO₂e) – could be avoided.

I

Parochial Moral Ambiguity
Allocating Company Car Emission Permits

Equity principles can be thought of as systematising codifications of day-to-day intuitions – of a sense of what is fair, or rather, what is unfair in familiar, everyday contexts. And even if they are not, it stands to reason that concepts such as ‘moral complexity’ and ‘moral ambiguity’ are best explained in terms of down-to-earth, parochial examples. In this spirit, consider the following hypothetical situation. A city-centre firm has a ‘fleet’ of two company cars, both of the same type. It is obliged to administer a company car emission permit scheme, under which it is allocated a quota of permits which it has to share out amongst the users of its fleet cars (who can privately buy additional permits on an open market). Given the fleet vehicle type, the company quota covers 20km per working day under average driving conditions. Under the scheme, the distribution itself is left to the company. Management decides that the default distribution should be Per Capita, but that representations may be made for differentiations on equity grounds.⁶ Arthur and Bert have both recently joined the firm from outside town. They were both told that they will be given a personal company car, although neither of them has work-related travel – bar the daily commute. Arthur has found himself a country cottage about 25km from the office, while Bert decided to move into a terraced house in close proximity.

A Per Capita Scenario. Under this first scenario, money was not an issue in either Arthur’s or Bert’s housing choice, nor do they have family or other obligations to live where they have chosen to. In short, their choice of residence reflects nothing but their personal tastes. Given this, what would be a fair distribution of the company permits? Either of the two might, say, try and put forward a merit argument, but given their recent arrival neither of them has a performance history at the firm which might warrant such a differentiation. Failing this, the most likely course would seem to be an appeal to differentiated needs/necessity. Indeed, Arthur might well take this line of argument, for there is obviously a sense in which he needs more permits to drive to work than Bert. Yet he can hardly claim this to be a matter of necessity – of being forced upon him. (He could try and argue on grounds of being a slave to his own tastes, but this is not likely to be very successful.) Assuming the firm itself receives the permits free of charge, however, does allow for a credible justification of the Per Capita solution on egalitarian (resource) entitlement grounds: the permits are a state benefit for employees which – in the absence of regulation to the contrary (e.g. means testing) – must be interpreted as a ‘poll-benefit’: 10km/day’s worth to each of them.

This scenario – like the ones which are to follow – is morally complex in the sense of admitting different equity principles (framed in terms of ‘merits’, ‘needs’ or ‘entitlements’) to be brought up for consideration. Yet it is ‘by construction’ meant to be morally *unambiguous* in that one argument ‘wins out’ over all the others, namely the egalitarian resource entitlement argument for a Per Capita distribution. In light of the introductory comments, it should also be noted that this argument does not involve – indeed explicitly rejects – any considerations of relative wealth.

A Grandfathering Scenario. The particular ‘moral dominance’ pattern constructed in the previous story-line arguably changes if one assumes that Arthur is forced to live in the country, because – say, actually earning less than Bert – his salary does not allow him to live centrally. This would justify Arthur in claiming that he has greater needs for the permits than Bert. Indeed, if he were able to demonstrate that the place he got was the closest he could get to the city centre on his salary, then he would seem to have good reasons to claim the whole

⁶ Note that the Per Capita solution is taken to be the default not because of some higher moral appeal, but merely because of its minimal information demands, since all it requires is knowledge of the number of claimants involved – for more on the connection between information and equity, see Amartya Sen, *Resources, Values and Development*, Oxford: Blackwells (1984).

company allowance (Bert really has no real need for them, for he could easily walk). In short, Arthur could justifiably put forward an argument for a Grandfathering allocation in proportion to (required) car use and the company management, as arbiters, may reasonably decide that this outweighs any egalitarian entitlement argument – in particular if the firm actually has to pay for the permits. In short, in this scenario, Grandfathering may well be morally dominant by virtue of relative-poverty-based needs. Failing to be dominant, Grandfathering, thus justified, could hardly be denied equal footing with the egalitarian Per Capita proposal, which in turn would leave us with a morally ambiguous context. But let us consider a further variant scenario of this parochial family to illustrate such ambiguity.

An Ambiguous Scenario. Assume that Bert – in this case earning less even than Arthur – does not choose to live in town because he likes it, but because he needs to take care of his elderly mother (and consequently moves in with her). In this situation, it might well be that a requirement to purchase permits could deprive Bert from the possibility of at least visiting his beloved countryside. It would then not be unreasonable for him to reject Arthur's needs-based claim to all the permits. Indeed, if Arthur could actually afford to buy the permits he requires to commute, Bert might well himself claim the lion's share – if not all – of the company permits. Such a claim might be justifiable, say, in terms of the well-known Rawlsian difference principle. The story line here is meant to illustrate the possibility of similarly justifiable but incompatible claims. In this case both are justified in terms of needs (albeit of different kinds), but obviously there can be ambiguous contexts based on 'mixed categories,' say a justifiable need conflicting with a justifiable (resource) entitlement.

Summing up, apart from illustrating that there may be more to Grandfathering and Per Capita than mere greed, these deliberately parochial scenarios illustrate that distributive problems can not only be morally complex, but that in many cases turn out to be morally ambiguous by admitting incompatible yet equally justifiable equity-based solutions. It is in the context of such ambiguity that the Preference Score method we shall now turn to comes into its own by suggesting a fair way out of the potential deadlock.

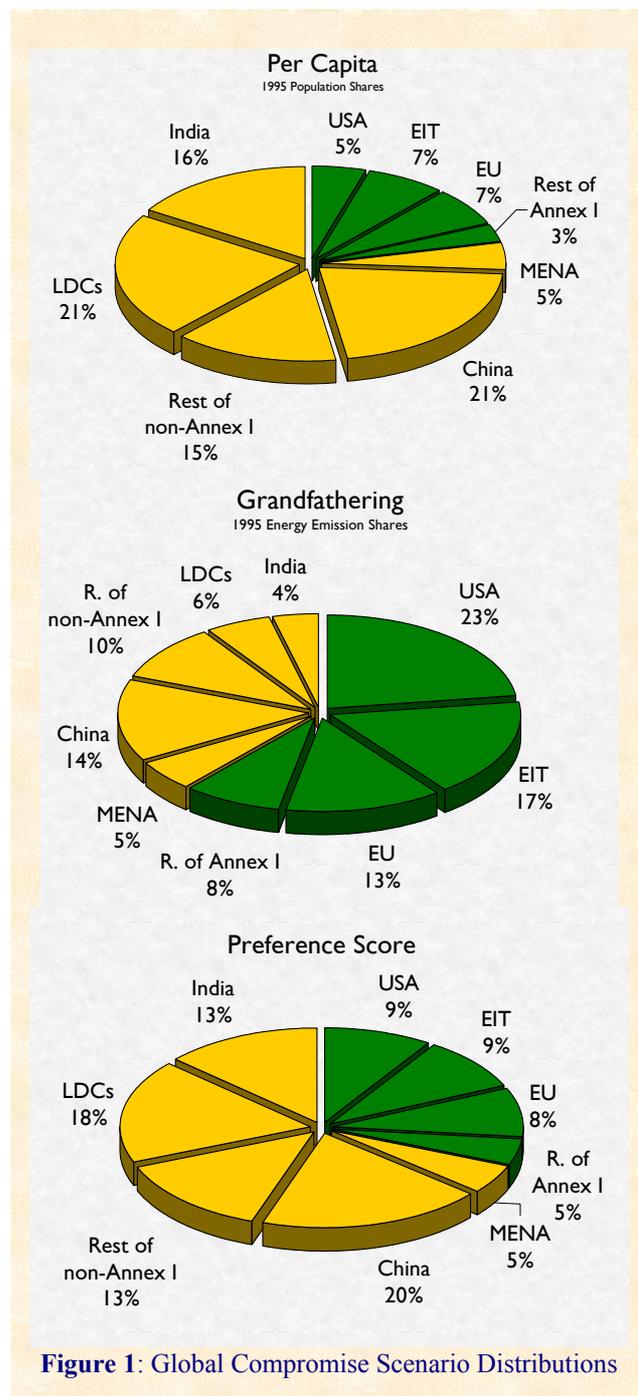
II

Preference Score Compromises

The Global Compromise Scenario. In Bartsch and Müller (2000), a ‘Global Compromise’ (GC) scenario is used to illustrate and model an application of the Preference Score method to the allocation of assigned amounts. The main analytic tool applied is a computable general equilibrium model of the world economy (CLIMOX) based on a 1995 data set. Its regional aggregation involves five Parties to the Framework Convention: China, the European Union (EU), India, Japan and the United States (USA); and a number of aggregate regions: ‘Asian Newly Industrialised’ (ANI), ‘Economies in Transition’ (EIT), ‘Latin America’ (LAM), ‘Least Developed Countries’ (LDCs), ‘Middle East and North Africa’ (MENA), ‘Rest of Annex I OECD’ (R-OECD)

The time structure of the scenario is given by six five-year periods, starting with a baseline period centred around the year 1995, and a final ‘GC-commitment period,’ with a 2020 mid-point. World GDP is assumed to grow annually in real terms by an average 2.5 per cent over the time horizon,⁷ and population growth is taken from the UN medium projections. The model is used to project energy emissions,⁸ and it is assumed that in the 2005 period, agreement is reached on how to allocate assigned amounts for the GC-commitment period.⁹ The presumption is, in particular, that the parties agree to apply the Preference Score method in case of a morally ambiguous situation.

The Preference Score (PS-) Method, as mentioned earlier, is a procedure for overcoming certain distributive impasses. It is applicable to any distributive dispute about divisible



⁷ For regional details on GDP growth rates see Table 2.

⁸ Carbon dioxide (CO₂) from combustion in all sectors and fugitive fuel methane (CH₄, measured in CO₂-equivalent terms) from gas distribution and coal mining and handling.

⁹ For modelling purposes a cap on global emissions is set at 34 per cent below 1995 baseline (14 per cent below projected BaU level), but since this is not crucial in the present context, the reader is referred to Bartsch and Müller (2000), in particular Chapter 13.

goods (or ‘bads,’¹⁰ for that matter). While setting the scene for an application of this procedure to a specific – though hypothetical – allocation of assigned amounts, none of the assumption so far is actually essential. The only pre-requisite is a consensus between the Parties about the positions (the ‘base-proposals’) which could justifiably be put forward in the distributive context in question. To simplify the exposition, let it be assumed that this consensus is reached with respect to just two base-proposals: Per Capita and Grandfathering (both with 1995 baselines – but let it also be understood that the method itself is by no means limited to two base-distributions). The first two illustrations in Figure 1 depict the relative shares of the total which our GC regions would be due under these two base-proposals.

A second set of assumptions essential to illustrating the PS-method concerns the Parties’ preferences between these base-proposals. Indeed, without such further assumptions, there may not even be a distributive problem in the first place, for if one assumes that each of the Parties

Table 1: ‘Global Compromise’ Scenario			
Annex I	2005 Population* (millions)	Preference Scores	
		<i>Per Capita</i>	<i>Grandfathering</i>
USA	292	0	292
Japan	127	0	127
EU	378	0	378
EIT	391	0	391
Rest	12	0	12
non-Annex I			
China	1,304	1,304	0
India	1,082	1,082	0
LDCs	1,569	1,569	0
Rest	944	944	0
MENA	335	0	335
Total	6,491	4,900	1,591
Preference Score Weights		<i>w_{PC}</i>	<i>w_{GF}</i>
		0.75	0.25

* UN Medium Projection, Source: Bartsch & Müller (2000)

would be in support of the proposal under which it gets least, then only 67 per cent of the ‘cake’ would actually be claimed. However, if one assumes – not unrealistically – that Parties’ preferences might be swayed by where they get more, then the proponents of Grandfathering as well as those of Per Capita would be demanding around two-thirds each (66 and 69 per cent, respectively), demands which clearly cannot all be satisfied. And since some assumptions need to be made about these preferences for the purposes of illustrating the PS-method, these acquisitive preferences are probably as realistic as

any.¹¹ Now, the basic idea underlying the PS-method is that the desired compromise is to be ‘synthesised’ in terms of forming a weighted arithmetic mean of the accepted base-proposals – in our case Per Capita and Grandfathering:

$$(PS) \text{ Assigned Amount}_{2020} = (Per\ Capita_{1995} H w_{PC}) + (Grandfathering_{1995} H w_{GF}),$$

where ‘*Per Capita*₁₉₉₅’ and ‘*Grandfathering*₁₉₉₅’ indicate the Per Capita and Grandfathering shares depicted in Figure 1, and $w_{PC} + w_{GF} = 1$. The use of this sort of ‘mixed proposal’ in the context of allocating assigned amounts is, of course, not new at all.¹² The method’s novelty lies merely in the provision of a procedure for establishing fair weightings. At the heart of this procedure is a rule for assigning preference scores, originally (1781) devised by Jean-Charles de Borda for use in the elections to the French Royal Academy of Sciences (and, accordingly, known as the ‘Borda rule’ – although most people on this Continent will be familiar with its slightly less august application at the Eurovision Song Contests). According to this rule, all members of the ‘electorate’ (the Parties) rank each of the ‘candidates’ (the base-proposals) according to their preference, and they express this ranking by each assigning

¹⁰ Thus is also applicable to find a fair compromise between different burden sharing positions. For more on the distinction between allocating assigned amounts and burden sharing, see Müller (2001).

¹¹ People of puritanical leanings might find such ‘the-more-the-better’ preferences objectionable. However, as long as the base-proposals are all (equally) justifiable on equity grounds, such objections cannot be sustained.

¹² See, for example, §3.5.4.4. of the IPCC WGIII Second Assessment Report.

0 ('nul point') to the least preferred candidate, 1 to the least preferred but one, 2 to the least preferred but two, and so forth.

Unlike in the Eurovision case, the Parties then multiply these individual scores by 'poll-weights' – the number of people they represent at the negotiations¹³ – to obtain the relevant preference scores, as listed in Table 1 (reflecting the stipulated 'the-more-the-better' preferences¹⁴). Although it is unlikely – in the absence of a 'quality-based access condition' – that Eurovision outcomes would improve under this sort of poll-weighting, they would arguably become fairer. For the purposes of the envisaged PS-method, however, such a poll-weighting has an additional advantage, for it makes the method 'collusion-proof': parties cannot manipulate what they get simply by deciding to unite or to segregate.

However, the key difference between the Borda rule and the Preference Score method lies in the fact that, unlike the former, the latter does not choose a winner, but employs the total scores of the 'candidates' to determine the weights in proportion to which they should be mixed together ('synthesised'). In the present case, the proportion between the two preference score weights is given by the proportion between the total scores obtained by the base-proposals, i.e. (see Table 1) $w_{PC} : w_{GF} = 4.9bn : 1.6bn$. As these weights are meant to be normalised (add up to 1), we thus have that $w_{PC} = \frac{3}{4}$ and $w_{GF} = \frac{1}{4}$. In short, given 'the-more-the-better' preference assumptions and the UN population projections for 2005, the Preference Score compromise shares (depicted at the bottom of Fig.1) turn out to be a mixture of three-quarters Per Capita and one-quarter Grandfathering.

The hope is that – being determined by the social desirability of accepted base-proposals – the Parties would regard such a mixture if not completely, then at least sufficiently fair to be an acceptable compromise. For this to be so, it is imperative that the Parties' preferred distribution proposals should be given equitable access to the process in the sense that proposals should be accepted for consideration if and only if they are 'equity-based' – justifiable on grounds of equity. This, of course, leads directly to the issues mentioned in the introduction to this note, in particular to the problem of an implicit rejection of the Per Capita proposal in denying assigned amounts the status of a natural resource.

¹³ The Per Capita baseline figures are generally not the same as these 'poll-weights'. For one, unlike the former, the latter are tied to a particular time period, namely the time of the negotiations. Moreover a Per Capita baseline may include restrictions – such as the one put forward by Michael Grubb who proposes that allocations should be restricted to people over a certain age, in order to avoid an undesired incentive for population growth (see M. Grubb, *The Greenhouse Effect: Negotiating Targets*, London: RIIA, 1989) – which may not necessarily apply to the poll-weighting.

¹⁴ Under the same preference assumptions, the PS-compromise for the Ambiguous Scenario of Section I – where both Arthur and Bert claim all – would simply be a fifty-fifty distribution.

III

In Defence of Resource Allocations

Righting All Wrongs. But why should one desist from interpreting assigned amounts in ‘natural resource’ terms? By treating the issue of stabilising greenhouse gas (GHG) concentrations as a purely environmental problem, it is possible to avoid the Utopian delusion of being able to right the world’s economic wrongs on the back of the climate change regime; or so at least I was recently told by an American, confessed ‘progressive pragmatist’ friend and colleague. There is nothing wrong with being progressive or pragmatic – indeed, started by Charles S. Peirce and William James, pragmatism has had a long and distinguished history in American philosophy – but care has to be taken not to confuse issues. For one, the aim of introducing ‘equity’ into climate change discourse self-evidently cannot be to right all wrongs, but must be to prevent further injustice caused by climate change decisions. As things stand, there will be climate change *impacts* whichever instrument is used to achieve whichever GHG concentration target, and while the impacts associated with a chosen stabilisation target must in some sense be deemed acceptable in aggregate,¹⁵ their regional distribution may nonetheless be unacceptably unfair, particularly when judged in terms of causal responsibilities.

At this point my pragmatist friend might well reply: ‘fair enough, but by avoiding the thorny fairness issues peculiar to resource allocations, at least we do not burden the process with more equity disputes than necessary.’ Although an age-old philosophical practice, this sort of ‘semantic denial’ – ‘resolving’ a problem by defining it away – is unlikely to satisfy those convinced that the issue of allocating assigned amounts should be treated as a question of resource allocation. And what is more, there is no guarantee that rejecting a resource interpretation – say by insisting on the ‘purely environmental’ character of the issue – would be sufficient to immunise the permissible emission debate against the sort of macro-equity questions often involved in resource allocations.¹⁶ This will become clear in the course of examining arguably the best known indicator-based alternative to which we shall now turn.

The WRI Proposal. In May 1999, Kevin A. Baumert, Ruchi Bhandari, and Nancy Kete of the World Resources Institute (WRI) published a study addressing the question: ‘What Might a Developing Country Climate Commitment Look Like?’ In it they concluded that

the stalemate [arising from US pressure for voluntary developing country commitments] stems, at least in part, from a default assumption evident in the current political debate that a developing country commitment would take the same basic form as an Annex I commitment – a limitation on the *absolute level* of GHG emissions. ... Fortunately, developing country participation under the Protocol or Convention can take a different approach. Because most developing countries are not currently in a position to make *absolute* emission reductions, the most immediate and realistic challenge is lowering the *greenhouse gas intensity* of their economies. Thus, rather than measuring the absolute amount of a country’s emissions, the GHG intensity indicator provides a more realistic and practical framework for participation by expressing the emissions that an economy generates *per unit of output*. This can be expressed as:

$$\text{GHG intensity indicator} = \frac{\text{GHG emissions}}{\text{gross domestic product}}.^{17}$$

Leaving aside the fact that emission *reductions* are by no means the only possible outcome for developing countries in the sharing of a global ‘cake’ of permissible emissions – viz. the discussion of the Per Capita proposal below – the authors cogently argue that rapid-growth

¹⁵ If stabilisation at a particular concentration level leads to certain impacts, then this level cannot be acceptable if the impacts as a whole are deemed to be unacceptable.

¹⁶ H. Peyton Young uses the term ‘macro justice’ to refer to ‘distributive justice in the large, ...the question of what constitutes a just social order.’ [*Equity*, Princeton University Press (1994):6], that is to say the sort of issues which are often judged in terms such as being ‘pro-’ or ‘regressive.’ Resource distributions are paradigm examples of decision problems giving rise to these type of social justice issues.

¹⁷ Baumert *et al.* (1999):2.

developing economies would be unwise to threaten their economic growth potential by adopting voluntary absolute emission targets for future periods. Instead they should aim to improve their economic ‘decarbonisation’ level by adopting a voluntary emission intensity reduction target (expressed as a percentage of the relevant *status quo* figure).

Box 2: Implied Assigned Amounts under GHG-Intensity Reduction

Baseline 1995, Commitment Period 2020

$$(1) \quad \text{Assigned Amount}_{2020} (\text{GHG-Intensity}) = \text{GDP}_{2020} \times \left(\frac{\text{GHG emissions}_{1995}}{\text{GDP}_{1995}} \times R\% \right) \quad 0 \leq R (<100)$$

$$(2) \quad = \frac{\text{GDP}_{2020}}{\text{GDP}_{1995}} \times \text{GHG emissions}_{1995} \times R\%$$

There is no doubt a lot to be said for this approach in the context of adopting voluntary (i.e. non-binding) commitments. However, the situation does get more complex if, as suggested by the authors, the approach is carried over to introducing *binding* commitments with the concomitant licence to engage in the Kyoto mechanisms.

For countries that wish to make binding commitments [...] commitments could still take the form of an intensity-based measure, such as a carbon intensity indicator, without losing the ability to engage in emissions trading.

However, a country making a binding commitment might want to engage in international emissions trading. In this case, the intensity indicator could be translated into an absolute level of emissions during the compliance period.¹⁸

In order to engage in these mechanisms, there is no getting around establishing absolute amounts of ‘allowable GHG emissions’¹⁹ – i.e. (absolute) assigned amounts – for the commitment period in question. The key difference between the WRI approach and the *standard* resource allocation approaches is one of timing: While the latter tend to determine the assigned amounts *ex ante* (prior to the commitment period), the former can only be applied *ex post*, for – as illustrated in equation (1), Box 2 – it is determined by multiplying the actual GDP for the period with the target emission intensity (itself equal to the baseline intensity times a percentage reduction factor *R*).

Box 3: Implied Assigned Amounts: Per Capita + Uniform GHG-intensity Reduction

$$(1) \quad \text{Assigned Amount}_{2020} (\text{Per Capita}) = \frac{\text{Population}_{1995}}{\text{Global Population}_{1995}} \times \text{Global GHG Cap}_{2020}$$

$$(2) \quad \text{Global GHG Cap}_{2020} (\text{GHG-intensity}) = \text{Global GDP}_{2020} \times \left(\frac{\text{Global GHG emissions}_{1995}}{\text{Global GDP}_{1995}} \times R\% \right)$$

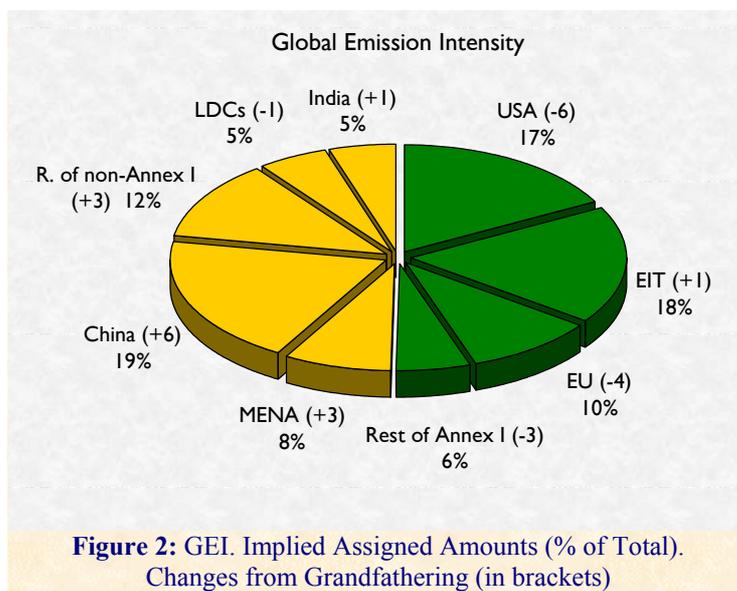
In the absence of perfect foresight, it is impossible to predict with certainty how much a Party will be allocated under such a scheme. Having said this, one should not ignore those features of the future which can actually be ‘predicted’ with certainty. For example, while the absolute value of future assigned amounts implied by this approach can only be estimated, it is very easy to ‘predict’ with certainty their relative proportions: they will be proportional to the baseline emissions times the economic growth, whatever it may actually turn out to be (Box 2). In other words, we are dealing with a variant of Grandfathering which includes an additional sweetener for economic high-achievers.

¹⁸ *Ibid.*:2 and 11, respectively.

¹⁹ *Ibid.*:11.

In view of our otherwise limited predictive powers, however, the only way of getting a more detailed grasp of the potential implications of this emission intensity approach is to engage in some hypothetical scenario exercises, i.e. to ask what would happen if the future turned out to be so-and-so. But before, I would like to put in a *caveat* concerning the relation between resource allocation approaches and the sort of *ex post* approach adopted by the WRI team: Even though resource-based proposals normally begin with an *ex ante* specification of a permissible global emission level (in absolute terms), they are by no means necessarily tied to this procedure. Indeed, as suggested in Box 3, it would be very easy to combine a GHG-intensity-based *ex post* specification of the total resource available,²⁰ and divide it according to the Per Capita or any other resource allocation rule.

The Global Emission Intensity (GEI) Scenario. To get an idea about potential impacts of GHG-intensity based approaches for the different kinds of actors in the climate change regime, we need to paint a plausible hypothetical picture of how the world might evolve over the time horizon in question.



In the course of a recent OIES project,²¹ the CLIMOX model was used to provide such a 'Business-as-Usual' (BaU) scenario for 1995 to 2020. To be quite clear, the description of the BaU-world economy in 2020 provided by this model is *not* meant to be a prediction, but merely a plausible picture of what the world, in the absence of climate change, would have been like in two decades time. Granted this, the question then becomes: what – if anything – could we conclude about some given

policy proposal, *if* the world without climate change would have been as assumed in our BaU scenario?²²

The particular policy proposal which I wish to shed some light on in this manner is a globally binding uniform reduction of GHG-intensities by the year 2020 from their baseline 1995 levels:

$$(GEI) \text{ Assigned Amount}_{2020} = GDP_{2020} \% GHG\text{-intensity}_{1995} \% R\% .^{23}$$

In order to compare the implications of this proposal with the analysis of the Section II resource allocation proposals, the level *R* of intensity reduction at the end of the time horizon (2020) is chosen so as to match the global emission reductions presupposed in the 'Global Compromise' scenario, which as mentioned earlier was used to analyse the impacts of the Per Capita, Grandfathering and Preference Score resource allocation proposals. To avoid misunderstandings, it has to be emphasised that this GEI proposal is related to but not

²⁰ Whether this would be an environmentally sensible thing to do must remain open in this context.

²¹ Bartsch & Müller (2000)

²² In light of the fact that we know that some climate change induced impacts are already unavoidable, it will thus be clear that these sorts of scenario exercises cannot be a matter of prediction.

²³ That is, in terms of the columns in Table 2: $G = D \% C \% 61\%$. Note that that BaU GDP data (D) are used as a proxy for the 'actual' GDP data which are unavailable short of a full modelling exercise. However, the effects of this are not likely to alter the qualitative results significantly – in particular since they are invariant under uniform GDP changes.

Box 4: Three Certainties about the GEI Scenario

The following three theorems are analytic consequences of the Global Emission Intensity assumptions.

- The assigned amount of a Party (k) under GEI (GEI^k) and under Grandfathering (GF^k) are the same if and only if its GDP growth rate (Γ^k) and that of all other Parties are the same.

$$GEI^k = GF^k \text{ if and only if } \Gamma^k = \Gamma^n \text{ (for all } n).$$

- Otherwise, the GEI assigned amount is greater (smaller) than the Grandfathering one if and only if the GDP growth rate is greater (smaller) than the average growth rate as weighted with the grandfathering fractions gf^k – i.e. greater (smaller) than the GEI 'growth sweetener' threshold

$$\hat{\Gamma} = (\Gamma^1 \times gf^1) + (\Gamma^2 \times gf^2) + (\Gamma^3 \times gf^3) + \dots :$$

$$GEI^k > (<) GF^k \text{ if and only if } \Gamma^k > (<) \hat{\Gamma}$$

- Increasing (decreasing) GDP growth increases (decreases) the GEI share of assigned amounts:

$$\text{If } \Gamma'^k = \alpha \times \Gamma^k \text{ then } GEI'^k > (=, <) GEI^k \text{ if and only if } \alpha > (=, <) 1.$$

identical with the one put forward by Baumert *et al.*²⁴ Nonetheless, most of the qualitative conclusions of this analysis should be easily generalisable to cover the WRI-case.

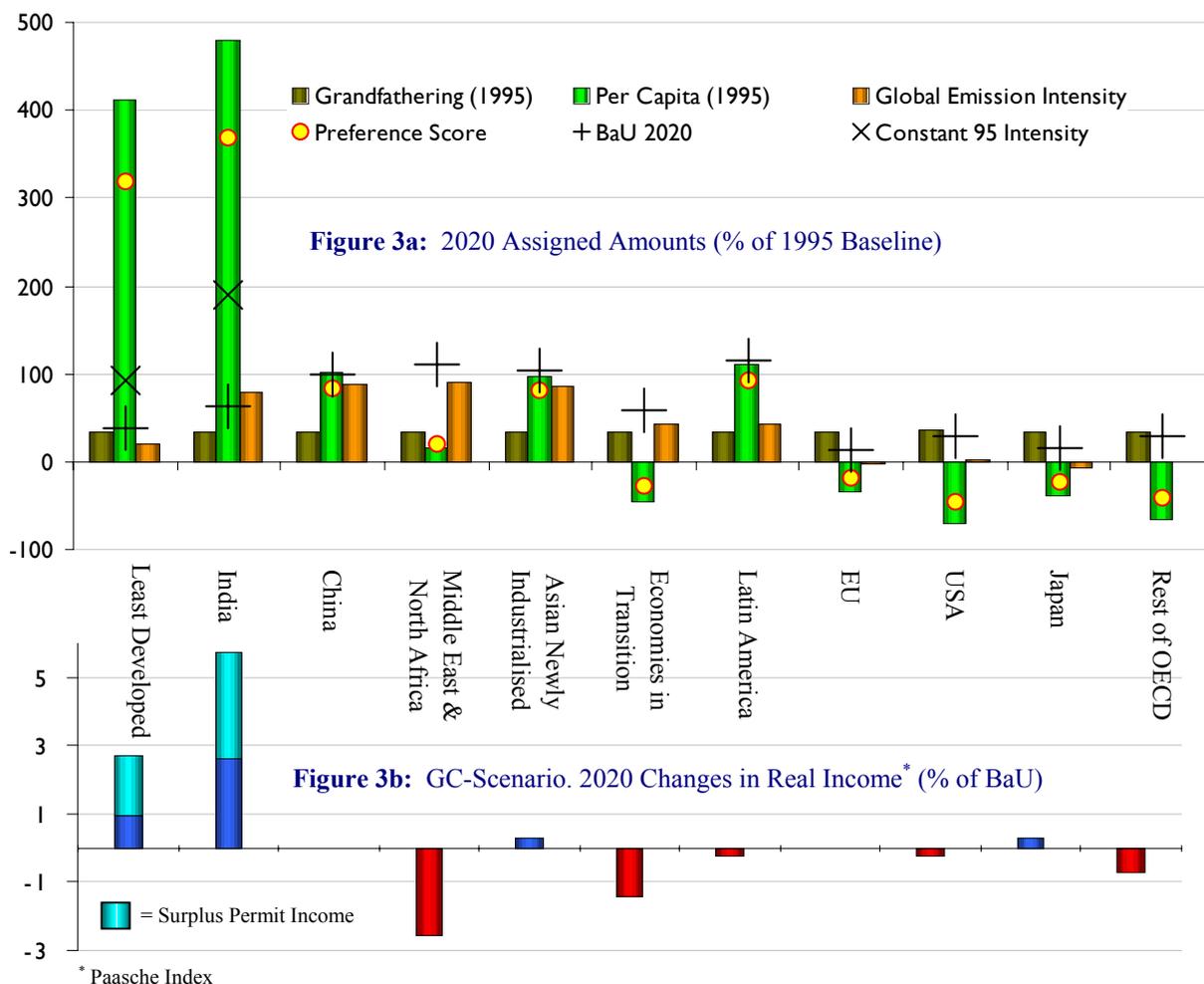
Figure 2 depicts the proportions of the assigned amounts which the different regions receive under the GEI-scenario. It also indicates the manner in which these figures differ from the Grandfathering shares, illustrating nicely the fact that the direction of these changes are driven by the position of the GDP growth rates relative to their (weighted) average – which in the present case happens to be 3 per cent (for a more precise statement of the relationship between GEI and Grandfathering, see Box 4). The fact that all the 'high development' regions (see Table 2) fail to profit from the high-performance sweetener in the GEI solution is unlikely to raise all too serious objections on moral grounds, but it is difficult to see how it could be acceptable that Least Developed Countries should be meted out the same treatment because of their below-average economic growth.

The reason that of non-Annex I, only the LDC region receives less than its Grandfathering share is largely due to the global nature of the GEI proposal. If we were to change the goal-posts by, say, excluding Annex I Parties (under a separate proposal) and implement our uniform emission intensity proposal only amongst non-Annex I Parties, the 'growth sweetener' threshold would immediately raise by about 1 per cent. This in turn would help balance the situation by also excluding India and Latin America from reaping the benefits of such a growth sweetener. And additional (intra-non-Annex I) inequities may arise from the fact that there is no discernible correlation within developing countries between emission intensity and level of development.²⁵

However, the clearest picture of the potential relative impacts of the different allocation proposals only emerges if they are presented in terms of target levels relative to the baseline year. To understand the difference between this presentation and the picture painted thus far, one has to keep in mind that a percentage point change in the share of assigned amount can have quite different effects on the target expression in terms of percentage changes from the scenario base year (1995). In the CLIMOX scenarios, there are two quite distinct bands of such effects: On the one hand there are four fairly 'robust' regions (USA, EIT, China, and EU) with a target change of 6–10 per cent for a one percent variation in assigned amount,

²⁴ For one, the GHG-intensity approach modelled here applies to all Parties – Baumert *et al.* are quite adamant that this may not be suitable for Annex I. They also see their proposal primarily for the purpose of adopting non-binding DC targets, whereas the argumentation here will be based on the assumption that the Parties in question would be allowed to engage in the Kyoto mechanisms.

²⁵ 'Among developing countries, there is no discernible relationship between carbon intensity and level of development. For example, China and India have similar per capita income levels, yet China's intensity is falling rapidly while India's is rising. Similarly, Chile and Malaysia have commensurate incomes but opposing trends in carbon intensity.' [Baumert *et al.* (1999):11]



while the rest react more forcefully with target changes between 27 and 38 per cent – all relative to the 1995 scenario baseline.

These target expressions are graphically represented in Figure 3.a which also indicates the projected emission percentage changes under the CLIMOX Business-as-Usual scenario. In terms of 2020 *BaU* levels, the Grandfathering requirements range from a reduction target of 77 per cent (Latin America) to a surplus of 131 per cent (EU). Indeed, Grandfathering generates surplus permits for all of OECD, while practically all non-OECD regions are faced with emission reduction targets. In the context of international permit transfers envisaged under the flexibility mechanisms, this could lead to the rather problematic spectacle of a South-North wealth transfer, easily recognised as archetypal ‘macro equity’ problem.

The GEI approach has less drastic North-South consequences. OECD countries have to return to roughly their 1995 baseline emissions and the carbon-rich high-performers are rewarded with below aggregate reduction targets. However, equity concerns are not exclusive to the North-South debate. The fact is that – at 13 per cent below 2020 *BaU* – the GEI reduction target for the Least Developed Countries is around twice the size of any other non-Annex I region (bar Latin America), and it is difficult to see how LDC could possibly comply without jeopardising their already limited economic growth (the idea, for example, that they would be able to compete with OECD countries in buying emission permits does seem fanciful). In short, macro equity concerns are raised even if assigned amounts are *not* explicitly recognised as a natural resource.

Naturally, LDC and India – as the two ‘low-development’ regions – could be released from the GEI regime, say by remaining fully outside the regime, or by being allowed to keep their 1995 emission intensities, which would lead them to the 2020 targets depicted as the

Table 2: CLIMOX Scenarios. Basic Data & Projections.

Countries and Regions	1995 Baseline				2020			Assigned Amounts			
	HDI	Energy Emissions	GDP	GHG Intensities	BaU GDP	BaU annual GDP Growth	Target GHG Intensities	GEI	Per Capita	Grandfing	Preference Score
	(a)	A (b)(c)	B (d)	C (e)	D (d)	E %	F (e)(f)	G (c)	H (c)	I (c)	J (c)
R-OECD	High	0.8	1.4	0.6	2.3	2.0	0.3	0.8	0.3	1.1	0.5
Japan		1.1	5.3	0.2	8.2	1.8	0.1	1.0	0.7	1.5	0.9
USA		5.3	7.1	0.7	12.0	2.1	0.4	5.4	1.5	7.1	2.9
EU		3.1	8.3	0.4	13.6	2.0	0.2	3.0	2.1	4.2	2.6
LAM		1.1	1.6	0.7	3.8	3.4	0.4	1.6	2.3	1.4	2.1
EIT	Medium	4.0	0.8	5.0	1.9	3.4	3.0	5.7	2.2	5.3	2.9
ANI		1.2	1.3	0.9	4.0	4.5	0.6	2.2	2.3	1.6	2.1
MENA		1.3	0.6	2.2	1.9	4.4	1.3	2.5	1.5	1.7	1.5
China		3.3	0.9	3.7	2.8	4.7	2.2	6.2	6.7	4.4	6.1
India	Low	0.9	0.3	3.0	0.9	4.1	1.8	1.6	5.1	1.2	4.2
LDCs		1.3	1.0	1.3	2.0	2.8	0.8	1.6	6.9	1.8	5.6
World		23.4	28.7	0.8	53.4	2.5	0.5	31.4	31.4	31.4	31.4

(a) 1995 UN Human Development Index. (b) CO₂ + CH₄ (Combustion & Fugitive Fuel). (c) GtCO₂e (d) Trillion 1995 US\$. (e) ktCO₂e/m\$ (f) 1995 level (C) – 40%. Source: Author, see also Bartsch & Müller (2000)

‘Constant 1995 Intensity’ case of Fig. 3.a. As both these options have the effect of exempting the two low-development regions from any (mitigation) obligations, one might at first sight be puzzled if some of the Parties involved were to prefer the latter of the two ‘GEI-release options’. The reason for such preferences are, of course, quite simple: in the presence of inter-commitment-period banking and international flexibility, the surplus permits associated with the second approach acquire a monetary value. They become a legitimately acquired national asset unavailable under the other two proposals.

Figure 3.b depicts the changes in welfare – relative to BaU and measured by the Paasche index – projected for the Preference Score allocation (of Section II) under the OIES ‘Global Compromise’ scenario. By selling emission permits (both surplus – clear blue bars in Fig. 3.b – and project-based) India receives on average \$33.5bn annually (or 3¾ per cent of its projected 2020 BaU Real Income), while LDCs receive \$41bn (2 per cent).²⁶ In light of, say, India’s 1995 export earnings of \$30.5bn,²⁷ these permits are significant revenue sources. Moreover, at less than half of the current figure for OECD development assistance, the 0.1 per cent loss in OECD real income due to implementing the Global Compromise scenario cannot be claimed to cripple the economies of the North.

Box 5: resource *noun*.

- 1.a A means of supplying a deficiency; a stock or reserve which can be drawn on when necessary; *N. Amer.* available assets
 b In *pl.* The collective means possessed by a country for its own support or defence.

Source: New Shorter Oxford English Dictionary

²⁶ Source: Bartsch & Müller (2000):241. All figures in 1995 US \$.

²⁷ Source: IMF, *International Financial Statistics Yearbook 1996*.

However, the main point here is that since (parts of) assigned amounts acquire monetary value under a permit trading regime, it is very difficult to see how they can be refused the status of a (natural) resource, at least in the North American sense of the term (Box 5). My progressive pragmatist friend – having been instrumental in introducing the flexibility mechanisms into the present climate change regime – may serendipitously have provided the key argument in favour of the resource interpretation of assigned amounts, and thus furnished the foundations for a justification of the Per Capita solution. To be sure, this is not to say that Per Capita is the only equity-based distribution proposal in this context, and – albeit my own preferred choice – an equitable compromise may have to be struck.²⁸ All it means is that it would not be right to reject Per Capita as an equitable proposal, be that explicitly or implicitly by rejecting assigned amounts as natural resource.

²⁸ There may be other compromise methods than the Preference Score method which might lead to an acceptably fair compromise. One which is often put forward, ‘Contraction and Convergence,’ however may carry with it the danger of short-changing least developed countries. For more on this issue I refer to a forthcoming piece entitled ‘Is “Per Capita Convergence” a Viable Fair Notion for the Developing World?’