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## TISS Background paper on equity in climate change mitigation

### Comments of Prodipto Ghosh:

I present my views below, on some of the significant assumptions and methodology adopted in the draft paper:

**General Comments:** The paper needs to make a clear distinction between *entitlements* to GHG emissions, which is the domain of equity, and, *actual emissions goals* that might result from the negotiations in the climate change regime. The first task for the negotiator is to persuade his negotiating partners that a particular equity formulation should indeed be the basis of entitlements. The subsequent task is, in the course of negotiations, to trade off various benefits and entitlements, to arrive at actual emissions goals of countries.<sup>1</sup> The latter exercise, cannot, I believe, be predetermined on the basis of any norm, since this would narrow or eliminate the scope for mutual trades, which are the very stuff of the negotiators' art, and key to arriving at consensus. Of course, actual emissions may differ from the agreed goals: these could be as a result of further trades in compliance based or voluntary carbon markets, as well as implementation failures, the challenge of redressing which lies in the design and operation of the compliance mechanism.

### Comments on specific issues:

1. **"Pollution versus Development Space arguments":** A strictly pollution elimination argument, preferred by many industrialized country Parties does not logically lead to the conclusion that "large" developing countries must immediately take on GHG mitigation commitments, differentiating them from other developing countries. (A "purely economic" argument, on the other hand, would require that mitigation should be accomplished where it is cheapest; this can be realized by means of global market based instruments, with the question of national endowments of GHGs, which is the good to be traded, lying in the domain of equity, which cannot thus be evaded).
2. **Equal per capita:** "...it is also evident that every nation's fair share of carbon space is proportional to its share of the global population": While the equal per capita Principle is certainly persuasive to many, one needs to contend with the fact that there are competing doctrines, e.g. squatters rights (adverse

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<sup>1</sup>The actual process of negotiations is, of course, extremely messy, and does not follow the two steps in sequence, which should then be seen as a conceptual, not an actual description of the negotiation process.

possession), (Kaldor-Hicks) efficiency, etc. The debate cannot proceed on the basis of appeals to intuition by proponents of the competing Principles, and each such candidate Principle has *survive tests of falsification, in terms of formal methodology*. This would merit further research.

3. **Carbon budget perspective:** Use of a fixed global carbon budget till a terminal year as opposed to (say) peaking year (citation needed) or aggregate global emissions in the terminal year (e.g. Indian presentation in the AWG-LCA workshop on Historical Responsibility): All GHGs follow a decay function after emission, and this makes the *time profile* of the emissions, and not just the aggregate over a time interval, relevant to the calculus. For example, a GHG may follow a first order decay function<sup>2</sup>:

$$\frac{dG}{dt} = -kG,$$

*where G is the concentration of the GHG in the atmosphere at time t*

*after emission, and k is a constant positive parameter characteristic of the GHG.*

Different GHGs would be characterized by different decay functions, and differing decay parameter values, even if following the same generic decay function. This fact gives the insight that the *actual time profiles of emissions of different GHGs, and not just the aggregate in terms of emitted in terms of CO2e in a given time interval* are relevant, since the GHG concentrations at different points in time is what matters for climate change, and not just the aggregate emissions. *The problem becomes intractable in practice, and incomprehensible to most negotiators.*<sup>3</sup> In the circumstances, the option of considering a fixed carbon budget over other alternatives (cited in the paper) is *no more or less scientifically defensible than the alternatives*.

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<sup>2222</sup> This decay function describes the profile of spontaneous decay of most radioactive elements. Some simple chemical reactions also follow this decay function. However, atmospheric chemistry being an extremely complex phenomenon, it is a major research challenge to identify the actual functional forms and parameters of decay functions for particular GHGs. Moreover, at least the parameter values may change with time due to ecological changes.

<sup>3</sup> Hence formulation of the “Global Warming Potential”(GWP), which is a rough summary of radiative forcing by different GHGs over various integration periods (25, 100, 500 years, etc. The choice of actual integration period is *political, not scientific*).

4. **Economic criterion employed:** “...guaranteeing of a sufficiency of carbon space for the economic development of developing nations”: What is “sufficient”? The various proposals of developed countries, particularly in respect of “large emitters” empirically translates to (just) sufficient to meet the MDGs goals.<sup>4</sup> The position of India and China (besides other developing countries) would, on the other hand, empirically translate to a potential for reaching a level of development commensurate with their other factor endowments, while facing an identical carbon constraint reckoned in per capita terms as that of developed countries.
5. **Choice of a start date for reckoning historical responsibility:** The notion of historical responsibility is firmly founded on the principle of “polluter pays”,<sup>5</sup> which can be shown to survive formal ethical criteria of falsification. However, the principle may be operationalized in the following ways:
- (i) Criminal liability: This requires either *intent* to cause harm (*mens rea*) or *knowledge* that a particular action is likely (not necessarily certain) to cause harm (to others in each case).
  - (ii) Civil (strict) liability: This requires the polluter to compensate damage caused to others by his action irrespective of whether the polluter *intended* to, or had *knowledge* that harm was likely.

*Both criminal and civil liability require judicial determination, and in a given case, both may apply (e.g. Bhopal)*

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<sup>4</sup> This much was acknowledged by Prof. Nick Stern in an informal interaction with the Indian negotiators in Poznan in December 2008 during CoP 14.

<sup>5</sup> How so? The point is that (historical) responsibility for a given level of pollution concentrations translates to responsibility for making good the harm, via the polluter pays principle. To the extent that a given agent pollutes less than others it is entitled in the net to receive payments from the others. Identifying ‘agent’ with natural person, and opting to deal with their collectives (i.e. countries) yields the notion of historical responsibility of countries, scaled in proportion to their respective populations.

- (iii) Restitution/Reparations: This is similar in concept to civil liability, except that the determination is through *voluntary negotiation, and not judicial action*.<sup>6</sup>

The question of start date for reckoning historical responsibility depends upon the choice of operationalization paradigm. If one is in the space of criminal liability, one may argue that developed countries are innocent, having neither knowledge<sup>7</sup> of, nor intent to, harm, till (say) 1972. If in the space of civil liability or restitution/reparations, only a start date corresponding to start of increase of GHG concentrations is material.

In the global climate change negotiations, which are *political* in character, albeit intended to lead to legal outcomes, neither civil nor criminal responsibility are at issue.<sup>8</sup> Rather, one is in the space of (politically) negotiating restitution/reparation. In this circumstance, any date other than one reasonably corresponding to the start of rising GHG concentrations cannot be justified.<sup>9</sup>

6. **Sharing of available carbon space**: Restricting the question of equity in mitigation as one of sharing the remaining carbon space (as opposed to full reckoning of responsibility for emissions starting from a defined initial year to a defined terminal year) makes the exercise restrictive. Even within the acknowledgement of a hard global constraint of available carbon space, the possibility of *negative* entitlements of particular countries (as well of significant *increase* in entitlements of others), can result in staying within the global emissions constraint. The point is that equity in mitigation is about determination of *entitlements*, not of *actual* emissions goals of particular countries, the

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<sup>66</sup> Judicial proceedings may, however, apply in the context of assertions that the negotiations were conducted under duress, etc.

<sup>7</sup> Factually, the developed country assertion is untenable. Arrhenius demonstrated before the industrial revolution was underway that increasing concentrations of CO<sub>2</sub> in the atmosphere would lead to increase in global temperatures. Considering that many of Arrhenius' other scientific contributions in chemistry were among the cardinal knowledge foundations of the industrial revolution, the absence of consideration to this particular finding, and thereby absence of knowledge of the likelihood of harm, is difficult to accept.

<sup>8</sup> It is possible that the question of civil liability could be independently pursued through courts having the requisite jurisdiction, relying on available international jurisprudence of liability for transboundary pollution. This is not an issue at present in the climate change negotiations.

<sup>99</sup> The actual date for start of increasing concentrations is both an empirical and a political matter; however, there is broad acceptance of 1850.

difference between the two, within any agreed equity paradigm, being met through trade of benefits, as pointed out above in the general Comments.

7. **Static versus Dynamic allocations:** A carbon budget approach need not entail periodic reallocation of emissions entitlements. Countries would need to live within their aggregate allocations till the terminal year; *the precise shape of the emissions trajectory is immaterial for the climate so long as the area under the curve does not exceed the country's entitlement.*<sup>10</sup> Why should one bother about precise trajectories so long as each country lived within its entitlement, thereby ensuring that the global constraint is not breached? In fact a strong argument may be made that countries are the best judges of their respective situations, further constraining their policy choices may lead to loss of individual (country) and collective (global) welfare. *There may be pragmatic reasons for negotiating actual time paths of emissions, but an equity argument for this is difficult to make.*<sup>11</sup> On this point, see my General comments at the beginning.

8. **Modeling details:** An optimization model is unnecessary under static allocations, and is only necessary to arrive at dynamic allocations. In general, optimization (or mathematical programming) models comprise a (single)<sup>12</sup> policy objective; a causal relationship linking the objective to various policy and exogenous variables; and a set of systemic constraints. The model then picks the set of policy variables for a given set of exogenous variables to maximize or minimize (as the policy problem may require) the value of the objective.

In policy making, *the choice of the objective function requires justification.* In the present case, it would require *ethical justification, or equivalently, it must derive from the Ultimate Objective*" of the UNFCCC (Art 2), which bears recapitulation::

*"The Ultimate Objective of the Convention and any related legal instruments that the Conference of Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas*

<sup>10</sup> This is true so long as one does not take the decay functions of GHGs into account.

<sup>11</sup> Of course the reason why countries are negotiating entitlements at each point in time has to do with the fact that they do not trust each other to actually live within their aggregate entitlements, and are also seeking near term economic advantage.

<sup>12</sup> Of course policy making frequently involves multiple objectives. To arrive at a single objective *function*, several objectives may be amalgamated by an aggregation function (for example by a linear function with fixed weights attached to each policy objective, in case of linear optimization models).

concentrations in the atmosphere at a level that would prevent dangerous *anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner.*"

The first three 'objectives' (prevention of dangerous anthropogenic interference, ecosystems to adapt naturally, food production not to be threatened) as stated in Art 2, are actually constraints in the terminology of mathematical programming. Conceptually, they are collapsed in the concept of a defined limit to rise of global temperature by a given terminal year, or alternatively, a global carbon budget over that period, as in the paper under review. The further ethical requirement of ensuring that actual entitlements correspond to the respective "fair shares" (a central theme of the paper) provides another set of programming constraints That leaves only "economic development" as a possible objective function that may be employed, if the exercise is within the domain of the UNFCCC.

The model as specified is not consistent with this structure. *As specified<sup>13</sup> the objective function in the model<sup>14</sup> has no roots in the UNFCCC (or for that matter any discernible ethical principle), and for that reason, is implausible as a global basis for determination of emissions trajectories of countries.* That leaves the open the possibility that the authors commend this Objective function as an appropriate negotiation norm, to arrive at countries' time paths of emissions. However as pointed out in the general comment at the beginning, this is implausible because *it would constraint the negotiation process* which involves trades of benefits.

A specification that may be more consistent with the UNFCCC would be as follows:

***Maximize (Global GDP)***

***Such that:***

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<sup>13</sup> Apendix I

<sup>14</sup>The objective function in the model seeks to minimize an absolute sum of deviations of aggregate global emissions from the global budget, actual shares from fair shares (defined in absolute, not fractional, terms, and "acceptable" per capita country emissions from actual per capita country emissions. While this specification may entail a rapid convergence to the global budget, it is not self evident that it is founded on a defensible ethical Principle( – this also plays into the argument of the "environment first and last" school), or indeed any Principle derivable from the UNFCCC (e.g. the Ultimate Objective, which includes economic development). It seems to represent a norm which the authors *seek to urge* upon policymakers, but cannot be argued to be an equity Principle. Further, the notion of "acceptable per capita emissions" (at given points in time) seeks to prejudge the entire negotiating agenda on GHG mitigation. If this could be agreed as a prior, the actual negotiations would be trivial.

$\sum(\text{emissions of country } i) \text{ for all } i \leq \text{Global carbon budget}$

$\text{Emissions of country } i \leq (\text{Fair share of country } i) * (\text{Global carbon budget})$

where  $\sum(\text{Fair shares of country } i) \text{ over all } i = 1$ ,

and  $(\text{Fair share of country } i) \text{ may be positive, negative, or } 0$ ,

*i.e. Fair shares are defined in terms of fractions of the global budget)*

$\text{GDP of country } i = Q_i (\text{capital, labour, land, technology, emissions of country } i)$

and

$\text{Global GDP} = \sum Q_i (\text{GDP of country } i) \text{ for all } i$

Where  $Q_i$  is the macroeconomic production function of country  $i$  and the global carbon budget embodies the first three “objectives” of Art 2. It may be noted that in this specification, no time element is involved (so long as the entire exercise is within the budget period). *This is consistent with the static allocation approach.*

It *should be clear that the problem is intractable*, being too intensive of information requirements. Moreover, it is unclear that countries would accept (i) that Art 2 implies maximization of global GDP; or (ii) that GDP is an appropriate representation of “economic development”. (The General comment that it would overly constrain the negotiation process also holds in this case).

The only way out is to establish the emissions *entitlements* of countries based on formally defensible ethical norms (i.e. equal per capita after accounting for historical responsibility), and thereafter negotiate time paths of *actual emissions* of each country, based on pragmatic considerations, as well as the trading off of various benefits and obligations.

9. **Results of the model runs:** It should be kept in mind that, if one adopts the global carbon budget approach, together with the equity Principle of equal per capita entitlements to emissions, all possible time paths of individual country emissions are *ethically equivalent* so long as none exceed in the aggregate (over the specified time period) their computed “fair share”. The actual time paths as provided by the simulations reflect in addition, two other norms (i.e. the defined “Objective function” and the concept of “acceptable per capita emissions” of particular countries at various points in time). Since these latter norms do not relate to either any formal ethical Principle, nor the UNFCCCs “Ultimate Objective”, it is not possible to characterize the time paths provided by the

simulations, as resulting inexorably from operation of the equal per capita Principle.

It should also be clear that restricting the notion of “fair shares” to strictly positive shares of the remaining carbon space, *as opposed to “fair shares” over the entire carbon space from the start year (i.e. 1850 or 1972) to terminal year (2050 or 2100)* is what yields the result of loss of carbon space for India and China. Re-specification of the model to full accounting for historical responsibility, on the other hand<sup>15</sup>, would yield significantly increased carbon space for developing countries in general (as shown in the Indian presentation at the AWG-LCA workshop on historical responsibility) in June 2009 at Bonn.<sup>16</sup>

A robust result from the model simulations is that a unilateral commitment by India not to exceed the per capita emissions of developed countries leads to significant *gifting away* of carbon space by India to others. This result is robust in the sense that it would hold irrespective of whether one is sharing the remaining carbon space, or the carbon space over the entire reckoning period from the start year to the terminal year.

**10. Strengths and weaknesses of the paper:** In my view, the paper suffers from the following strengths and infirmities:

**Strengths:**

- (a) It asserts categorically that equal per capita is the relevant ethical norm on the question of entitlements to carbon space, and provides an illustration of how it may be operationalized.
- (b) It illustrates the danger (i.e. loss of carbon space) for India and China (and developing countries generally) in restricting consideration of emissions entitlements to the *available carbon space* (till say, 2050), as opposed to *full reckoning of historical responsibility* (say, over 1850 to 2050).

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<sup>15</sup> Which would allow for negative (absolute or fractional) “fair shares” of particular countries.

<sup>16</sup> As pointed out in the General comment above, entitlements may not be identical to actual emissions – the difference would arise from the trading of benefits and responsibilities in the course of negotiations.



- (c) It also shows that changing the start date for historical responsibility from (say) 1850 to (say) 1972, has the potential to drive a wedge between the interests of India and China.
- (d) It also illustrates the danger (i.e. loss of carbon space) for China and India in adopting constant population for reckoning “fair shares”, as opposed to varying population figures. (However, the ethics of constant versus varying population are not discussed. This aspect may be left for future work).

**Weaknesses:**

- (a) Rather than enunciate and *formally defend* an ethical principle for allocation of carbon space across countries, it simply *asserts as axiomatic* the equal per capita principle. The validity of the equal per capita principle (as well as other competing Principles) in GHG mitigation is, in fact, largely what the global debate on equity in mitigation is about. (The equal per capita Principle would, in fact, survive tests of falsification; most of its competitors would not).
- (b) The justification for adoption of the base year of 1970 (or 1972) , as opposed to the start of increase in global GHG concentrations, would be consistent with realizing historical responsibility through *criminal*, as well as non-criminal approaches. *In the context of the global climate change regime, criminal liability is implausible.*
- (c) The approach to dynamic allocation of emissions entitlements of countries relies on the specification of a global policy objective, and a concept of “acceptable per capita emissions” of particular countries at different points in time. While these approaches may be urged for adoption by the authors, it is has no basis in the UNFCCC or any discernable ethical principle, and since it would constrain the negotiation process, unlikely to be persuasive to negotiators.