

Josef Baum, Austria

Economic Regional Ecological Research
Kaiser Josef-Straße 57/34, A-3002
Purkersdorf Austria
+43 2231 64759 +43 664 1142298
baum.josef@utanet.at

9th Annual Conference AHE – Bristol 13-15 July 2007

Pareto optimal Sinking in the Climate Change or Redistribution –
The “Brazil Proposal” and Equity Concepts for Burden Sharing
of Mitigation Activities on Climate Change

(Final version)

Abstract

Framing climate change as an equity issue probably will be a very central question for our planet. The burden sharing of mitigation on climate change could trigger off extreme global conflicts. Within the Kyoto process Brazil made a proposal to set differentiated emission reduction targets according to the impact of historic emissions of countries. First results of international research on calculations are available. The historical world–system approach gives a background theory combining asymmetric accumulation of capital and emission of harmful substances. So we see very differentiated emissions per capita for global core, semi-periphery and periphery, but also intraregional correlations of stratification along income, classes and gender.

Very different equity concepts for burden sharing for mitigation activities on climate change are thinkable. Accepting equal rights via equal quantity of emissions per capita seems to be very radical, but considering the accumulation of historic emissions in different regions has still more far-reaching consequences for “early polluters”(most OECD-countries), and even more the use of a functional concept (emissions for whom) instead of a territorial (emission where).

Obviously we can choose sinking Pareto optimally in the climate change or to overcome an asymmetric world and forestall worst implications of climate change by convergent redistribution. Anyway the issue of global (re)distribution now evidently seems to be inseparably intertwined with the possibility of feasible solutions for the climate change issue. More: The tough interrelation between distribution and the future of the planet seems to be a completely new situation for mankind.

Overview

- **The great question for our planet**
- **The “Brazil proposal” and institutional aftermaths (MATCH)**
 - A lot of methodological problems**
 - Some methodological conclusions of MATCH**
 - Preliminary MATCH-results**
- **Sensible implications for constituting equity**
 - A parable on 4 solutions on equity in the environmental space in climate change**
- **The historical world–system approach - asymmetric accumulation of capital and harmful substances**
- **Intraregional differentiated emissions per capita**
- **Equity Concepts for Burden Sharing on Climate Change Mitigation Activities**
- **150 years emission moratorium for the USA (50 years for the EU) to reach a just share?**
- **Pareto optimal sinking in the climate change or redistribution**

Full paper

The great question for our planet

Human mankind faces unprecedented challenges by the impacts of climate change. Although there are signs that climate change still accelerates, the awareness to start fundamental mitigation measures¹ till now does not increase to an adequate extent to transform policy on the large scale.²

But the time to mitigate the climate change seriously probably will come - maybe just after very unpleasant events. Then the question of burden sharing of the tremendously risen necessary mitigation activities on climate change will become aggravated. Anyway this great question of distribution will be the topic of still many conferences³ in the next decades, and

¹ See the fact that the Stern Review (2006) is discussed broadly (methodological issues in this report are not discussed here)

² See UN Climate Change Conference - Nairobi, 6 - 17 November 2006 <http://unfccc.int/2860.php>

³ “The history of the climate talks is one of division between developing countries wanting entitlements to be proportional to population, whilst the industrialised countries want entitlements proportional to the size of their economies’ GDP. The path to get from one to the other, from ‘grand fathering’ – unequal rights drawn down by historical precedent – to equal per capita shares, in contraction and convergence.” Christian Aid (2000): Who owes who – climate change, debt, equity and survival. p. 6

maybe the big issue of future extreme global conflicts. Broadly it is accepted: The divide between poor and rich is increased by climate change.⁴

The question of global distribution (mainly between north and south) is reformulated or supplemented by the equity issues of global change mitigation. In the following we do consider the status of global distribution on income, consumption and property rights only indirectly.

“Despite frequent references to intergenerational equity ..., climate change is only beginning to be framed as primarily an issue of equity”⁵. For example the Stern Review concedes: “CO₂-emissions have been strongly correlated with GDP per head across time and countries. North America and Europe have produced around 70 % of CO₂ emission from energy production from 1850 –while developing countries – Non-Annex 1 parties under the Kyoto Protocol – account for less than one quarter of cumulative emissions”⁶ But the consequences then are rather vague. Generally: “The implications of inequities related to climate change for human security have not, however, been systematically considered.”⁷

Framing climate change as an equity issue is becoming very central for solutions: “Resolving the climate change crisis will depend fundamentally achieving a mutually acceptable understanding of what is fair”⁸.

We also should look on the distributional effects of impacts (vulnerability) and adaptation to climate change. But here the pattern is much more complicated especially by geography, so we neglect these differentiated aspects of impacts and adaptation.

The “Brazil proposal” and institutional aftermaths (MATCH)

The issue has been indicated generally in some publications since many years⁹. Since some years there is a institutional and scientific process of evaluation in this direction: As part of the negotiations on the Kyoto Protocol, the delegation of Brazil made a proposal¹⁰, in May 1997, to set differentiated emission reduction targets for parties according to the impact of their historic emissions on temperature rise.¹¹ The proposal initiated meetings of experts¹² and roughly since 2002 there have been coordinated work and meetings also on the scientific level to find common basics do define possible political choices (by MATCH= Ad hoc Group Modelling and assessment of contributions to climate change). First the scientific and

⁴ Kromp-Kolb H., Formayer H. (2005): Schwarzbuch Klimawandel, ecowin. Salzburg. P.214. O’Brien-Leichenko refer studies that suggest that „climate change will further increase inequities rather than diminish them” O’Brien K., Leichenko R. (2006): Climate Change, Equity and Human Security. Die Erde 137 2006 (3), p 171

⁵ O’Brien K., Leichenko R. (2006): Climate Change, Equity and Human Security. Die Erde 137 2006 (3), p 165

⁶ Stern Review p 169

⁷ O’Brien K., Leichenko R. (2006): Climate Change, Equity and Human Security. Die Erde 137 2006 (3), p 166

⁸ Roberts J. T., Parks B. C. (2007): A climate of injustice: global inequality and climate change – vulnerability; responsibility and action. MIT Press. P.136

⁹ E. g. Martinez-Alier J. (1992) : Ökologische Ökonomie und Verteilungskonflikte aus historischem Blickwinkel, p.46. In: Beckenbach F.: Die ökologische Herausforderung für die ökonomische Theorie

¹⁰ Information on the Brazilian Proposal:

http://unfccc.int/methods_and_science/other_methodological_issues/items/1038.php

¹¹ [FCCC/AGBM/1997/MISC.1/Add.3](http://unfccc.int/methods_and_science/other_methodological_issues/items/1038.php)

¹² Report of the expert meeting: UNFCCC Overview status 2002

<http://unfccc.int/resource/docs/2002/sbsta/inf14.pdf>

methodological assessment¹³ of contributions to climate change should be clarified. After Some meetings¹⁴ the research converged to the first joint paper 2004 (Mainly by researchers from industrialised countries but also with some from developing countries)¹⁵. The process is documented to a large degree¹⁶. Now this activities seems to be in the status of refinement¹⁷. At the end of 2007 there should be a final report, 2008 opinions of governments shall be discussed. Anyway there has been still a lot of spin-off literature¹⁸.

A lot of methodological problems

The preliminary question is: Should the distribution of emissions of the past, the accumulated stock of harmful substances be considered or not? Should former emission activities account for future burden sharing?

The specific aim of MATCH is to provide clear guidance on the implications of the use of the different scientific methods, models, and methodological choices to various option if there is a positive answer to this question.

There are very sensible methodological problems in assessing methods for calculating the contribution of different (anthropogenic) emission sources (e.g. regional, national or sectoral) to climate change and its impacts. Some choices like time being considered cannot be based only on objective ‘scientific’ arguments alone, researcher can calculate some alternatives: The choice of main indicators for the measurement of global warming is to be made e. g. by

- Emissions (relatively best data)
- change of concentration
- change of radiative forcing
- sea level rise (highest relevance)

The most relevant and politically choice is the timeframe of considered emissions.

There is much difference between a 10 or 150 year time horizon.

The question of modes “backward discounting” also is very sensible.¹⁹

Scientific choices are

- Choice of the dataset on historical emissions
- Attribution methods
- Choice of the representation of different models climate system.

Some assumptions in the removal of CO₂ by the land use (like forests as sinks) have to be made.

Further choices are analysed: The considered mixture of greenhouse gases is sensible to the outcome because of different times of staying in the atmosphere and the “lag structure” for effects on weather. The inclusion and relevance of methane is sensible for the

¹³ http://unfccc.int/methods_and_science/other_methodological_issues/items/1038.php

¹⁴ Contributions of a meeting 2003:

<http://unfccc.int/resource/brazil/meet080903/pres080903.html>

Overview on the results of former meetings 2003

http://unfccc.int/resource/brazil/meet080903/present/nik_hoh1.pdf

¹⁵ Xiaosu Dai, Michel den Elzen, Höhne N. (2004)

[Ad hoc group for the modelling and assessment of contributions of climate change \(MATCH\)](#)

¹⁶ See: <http://www.match-info.net>

¹⁷ <http://www.match-info.net/> Presentation 7 May 2006 MATCH-Paper 1

¹⁸ See for some literature at the end

¹⁹ This concept is very remarkable because its logic contradicts the general time-increasing value at discounting

contributions of regions²⁰. Anyway CO₂ is a lead substance. The use of greenhouse warming potentials (GWP) cumulative weighted emissions could be another important option. Finally its necessary to take into account various uncertainties, and the sensitivity of the calculations to the use of different methods, models and methodological choices.

Anyway the important choices have to be made largely within the policy context.

Some methodological conclusions of MATCH

Two main factors influence results of regional contributions to global warming in MATCH-calculations:

- Whether a source emitted ‘early’ versus ‘late’
- The share of emissions of short-lived / long-lived gases.

Choosing a shorter time horizon (e.g. 1950 or 1990 instead of 1890) reduces the contributions of OECD90 countries (‘early emitters’) to temperature increase.

- A late end-date increases Kyoto non-annex-I contributions (developing countries), because it gives more weight to their larger future emissions.
- A later evaluation-date raises OECD contributions due to:
their large share in historical CO₂ emissions (long residence time)
and their small share of methane emissions (short residence time)

Preliminary MATCH-results

So main preliminary results of one group of MATCH-researchers are:

“We find that the relative contributions of different nations to global climate change—from emissions of greenhouse gases alone—are quite robust, despite the varying model complexity and differences in calculated absolute changes. For the default calculations, the average calculated contributions to the global mean surface temperature increase in 2000 are about 40% from OECD, 14% from Eastern Europe and Former Soviet Union, 24% from Asia and 22% from Africa and Latin America. Policy-related choices, such as time period of emissions, climate change indicator and gas mix generally have larger influence on the results than scientific choices. More specifically, choosing a later attribution start date (1990 instead of 1890) for historical emissions, decreases the contributions of regions that started emitting early, such as the OECD countries by 6 percentage points, whereas it increases the contribution of late emitters such as Asia by 8 percentage points. However, only including the fossil CO₂ emissions instead of the emissions of all Kyoto gases (fossil and land use change), increases the OECD contributions by 21 percentage points and decreases the contribution of Asia by 14 percentage points”²¹.

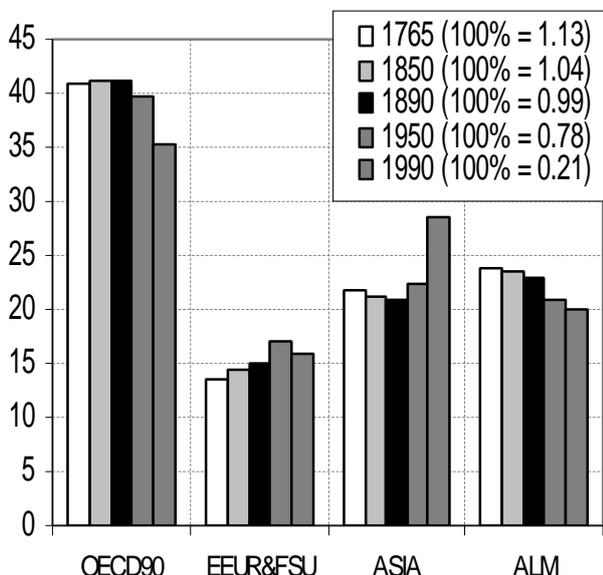
²⁰ E.g.: CO₂ remains more than 100 years in the atmosphere, methane only some 10-12 years

²¹ den Elzen et al, 2005 : Analysing countries’ contribution to climate change: scientific and policy-related choices, [Environmental Science & Policy, Volume 8, Issue 6](#) , December 2005, Pages 614-636

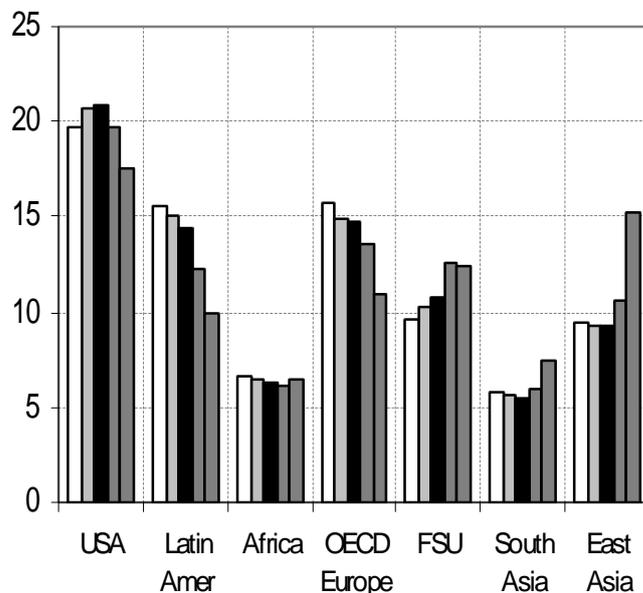
In this sense the following chart is relatively in favour of OECD-countries because it is not on the basis of CO₂ but on the basis of greenhouse warming potentials (GWP) cumulative weighted emissions:

Chart 1

% Contribution to temperature increase in 2000



% Contribution to temperature increase in 2000



EEUR: Eastern Europe
 FSU: Former Soviet Union
 ALM: Africa and Latin America

Contributions to climate change on the basis of greenhouse warming potentials (GWP) cumulative weighted emissions ²² (These are NOT per capita values but relative global shares)

Sensible implications for constituting equity

To converge to the (relatively high) level of 550 ppm CO₂ at the end of the century European countries would have to get at least roughly 80 % below the actual level²³

If the principal option of historical calculation is accepted for sharing the burden of global mitigation we would have *to go even much farther*.

The aim of MATCH “only” is to calculate various of calculations of regional distributions of (historic) contributions to global warming.

Critical questions arise with far-reaching conclusions for global distribution if the results of the (historic) contributions are definitely:

- What are equal rights to the atmospheric commons (the global capacity to absorb carbon is a depletable resource)?
- Which general concepts of equity have to be used?
- What pattern of global distribution in reducing rates on emission should be implemented for convergence (speed, milestones)?

²² <http://www.match-info.net/> Presentation 7 May 2006 MATCH-Paper 1

²³ Stern Review p xi (Global peak around 2020 and then global annual reduction rate of 1-2%)

A parable on 4 solutions on equity in the environmental space in climate change

Two farmers work on a field. One returns home for eating, the other remains - eating only a little snack. The one having returned immediately starts to eat the prepared meal in the common home. When the other is also returning home the meal is eaten for 50 %. Now they dispute about the belonging of the rest of the meal. There are different possible notions of equity.

- 1. The one who returned first said: "I am accustomed to eat much, I am still hungry. You are accustomed to eat only a snack, so it is just and efficient to divide the rest 4:1 ("extreme grandfathering", the US-Bush-solution²⁴),*
- 2. but I will reduce a little bit, and you can even double. Let's make 3:2 (Kyoto, subtle grandfathering)*
- 3. The man coming late said: it's very complicated. Lets make a simple rule: Everyone gets the same share – of the rest (2,5:2,5). This is very generous of the late coming (Opinion of G-77 block)*
- 4. An observer could say: the one has eaten much. Everyone should get the same share – of the entire meal. So they should divide 0:4 or for to be friendly 1:4 (this would be the tendency of the Brazil proposal)*

The historical world–system approach - asymmetric accumulation of capital and harmful substances

A useful background for understanding the historical development of emissions is the world-system theory: What is the world-system approach? The historical "world system" theory of Immanuel Wallerstein, Giovanni Arrighi, Samir Amin, Andre Gunder Frank and others is an adequate framework for analyzing global issues²⁵: The historical "world system" theory is rather young and there is still much work in progress. Central threads are:

- Every social process on earth has to be seen as a part of a interacting world system.
- For analysing the main processes it is important to consider the historical tendencies of the last 500 or at least 200 years.
- By explaining core, semicore (semiperipheral) and peripheral positions in the world–system by labour division and power it highlights the big and persisting gaps in development on our planet
- It is an adequate basis for interdisciplinary research, especially for connecting political economy with political ecology
- It enables the global not-eurocentric vision²⁶
- The theory is dynamic with open end

²⁴ The US-administration has made ratification of the Kyoto Protocol conditional on "meaningful participation" by developing countries. Science vol. 289, 29 September 2000. The US-administration equal proposes equal carbon intensity (CO₂/GDP)

²⁵ Wallerstein I. (1974,1980, 1989): The modern world system", 3 volumes. See also works of Amin S., Arrighi, G., Frank A. G.

More: Fernand Braudel Centre for the Study of Economies, Historical Systems, and Civilizations:
<http://www.binghamton.edu/fbc/>

²⁶ "In 1995, documents prepared by economists in the UN caused outrage by attempting to estimate the impact of global warming by placing a cost on the number of lives lost. To do their sums, they valued the life of someone in a developing country at 62,500, against a life in Europe on the US being worth 940,000." Christian Aid (2000) p. 9 - Business as usual at cost benefit analysis

The main fundamental concept is dynamics of **asymmetric global accumulation of capital**. This asymmetric global accumulation of stocks of (physical) capital historically is connected intrinsically with flows of material and emissions, and the **accumulation of stocks harmful substances** in nature/ecological cycles.

There is already done some work on explaining the dynamics of socio-economic background of emergence of climate change in the context of world–system approach. E. g.: “In examining the social concomitants of greenhouse gas emissions, we find that CO₂ production is most closely associated with the core position in the world–system, and that methane production is most closely associated with the semicore position. We believe both of these associations can be best understood in a world–system framework.”²⁷.

But the historical pattern does not have only a north-south dimension: “... climate change equity is not simply a North-South issue, but an issue that cuts across national boundaries and needs to be addressed at different scales and units of analysis. ... but to new inequities generated by climate change. Recognition of climate change as an issue of equity that selectively undermines human security of some regions and groups...”²⁸

Intraregional differentiated emissions per capita

We see a correlation of stratification along income strata, classes and gender, so we meet differentiated emissions per capita resp. differently affected impacts of climate change. Some highlights on the differentiated emissions per capita within a country:

- Systematic statistics for households in Austria hold for a very differentiated extent in using cars dependent in income: the 40 km per household a working day in the second quartile (income) doubles the first (20 km), the third shows some 53 km, and in the upper quartile we see 80 km, the 4-fold of the first quartile²⁹. If we assume proportionate emissions along the daily way by car, and if we consider that the emissions of traffic are the most dynamic part of climate relevant gases, we see very different contributions dependent on income.
- The consumption of the traffic services is also very differentiated to social classes in the historical development. For the year 1912 the traffic budget for Swiss regions was analysed for different incomes. The share of the traffic budget approximately is similar in all income classes: about 2% (the smallest incomes with 1,8%). According to the high income dispersion - lowest income class reaches 1,000 Swiss francs yearly incomes defined, the highest 10,000 to 20,000 - the similar portion of the traffic budget in the various classes of income absolutely is very differently (18 Swiss francs in the lowest income class, 400 in the highest income class)³⁰

²⁷ Burns, Thomas J., Byron L. Davis, and Edward L. Kick. (1997). "Position in the World-System and National Emissions of Greenhouse Gases." *Journal of World-Systems Research* 3: 432 - 466.

²⁸ O'Brien K., Leichenko R. (2006): Climate Change, Equity and Human Security. *Die Erde* 137 2006 (3), p. 165

²⁹ Steininger K., Gobiet W. (2005): Technologien und Wirkungen von Pkw-Road Pricing im Vergleich, Wegener Center Graz, Bericht 1/2005, p 20f

³⁰ Frey T., Schiedt H.-U. (2005): Wie viel Arbeitszeit kostet die Freizeitmobilität? – Monetäre Reisekosten in der Schweiz 1950-1910, In Gilomen H.-J., Schumacher B., Tissot L. (Hg.): Freizeit und Vergnügen vom 14. bis zum 20. Jahrhundert, Chronos, p 159

- "...middle and higher income consumers are often more easily able to make lifestyle adjustment to meet these requirements than are poorer consumers"³¹
- Women cause less emissions in transport.³²
- The extent of worldwide inequality widens once again dramatically when men of different income are compared: an average US citizens emits 540 CO₂ times more than citizens in Ethiopia, Burundi, Afghanistan and similar countries. If US- millionaires are compared to the mass of poor people in these countries the relation becomes 1: 10.000 or 100.000³³

These highlights give some hints that a worldwide CO₂ reduction programme is confronted with complex intertwined equity issues.

Integrating intergenerational and intragenerational distribution by an IO-framework

Political economy can be supplemented by *political ecology*. James O'Connor (1988) discussed "the second contradiction of capitalism". The labour value theory seems to be an important cornerstone of a general socio-economic theory. But to be a powerful instrument for the explanation of reality this core has to be enlarged by ecological (energy and resources, decreasing potential of resilience of ecological media), gender, and spatial issues.

In the sense of world-system approach I intend to develop in a research programme a "world model" integrating ecological and economic issues. Hardy Hanappi (2003)³⁴ wrote a basic paper on an input-output-based framework integrating gender and world-system approaches to labour value theory. I want to extend this by an ecological dimension. So *intergenerational* and *intragenerational* distribution are integrated by an IO-framework.

Because a central ecological dimension is the time dimension discount rates matter very relevantly and sensitive for accounting global historic distributions and impacts. Discount rates being significant higher than 0 depreciate any (mid-term and) long-term ecological harm. This practically means to find solutions for appropriate (time) discount rates.

This will be the core of *intergenerational* distribution on the time axis

The *intragenerational* distribution on the horizontal axis is the distribution between

- classes,
- regions (space), and
- gender.

If we connect different dimensions, for example upper classes in the north with "elites" in the south and combine these as one unit we can confront it then with the rest of the world. The supposition is that the discrepancies will be still stronger than for the differences between countries.

³¹ O'Brien K., Leichenko R. (2006): Climate Change, Equity and Human Security. Die Erde 137 2006 (3), p 170

³² VCÖ (7.3.2007): Frauen sind klimafreundlicher mobil als Männer! Press release. Vienna

³³ Roberts J. T., Parks B. C. (2007): A climate of injustice: global inequality and climate change – vulnerability; responsibility and action. MIT Press. P 146-8; 284

³⁴ Hanappi H., Hanappi-Egger E., Elements of an I-O-based Framework for Marxian, Feminist and World-System Approaches, in: Kohler G. and Chaves E. (eds), Globalization: Critical Perspectives, Nova Science Publishers, New York, 2003

By combining different economic and ecological input-output parameters the distribution of historical emission could be further assigned and equity concepts could be refined.

Equity Concepts for Burden Sharing on Climate Change Mitigation Activities

Fundamentally concepts could be oriented to stock or to flows of matter, energy and values, or to a combination of them.

Notions of equity and justice are defined very differently. In the case of mitigation of climate change mitigation the notions of equity and justice seem not to be primarily moral principles but conditions for succeeding.

equity concept can refer to outcome and/or process equity³⁵

Here only roughly some basic concepts on outcome are noticed. Real concepts could be combinations of types.

Some conceivable principles or targets for reduction of global greenhouse gas emission:

1. *Equal absolute reductions*
2. *Equal relative reductions*
3. *Equal quantity per capita for future emissions from now on – in spatial terms*
4. *Equal quantity per capita for future emissions from now on – in functional terms*
5. *Equal quantity per capita considering (all) historic emissions – in spatial terms*
6. *Equal quantity per capita considering (all) historic emissions – in functional terms*
7. “Efficiency”-targets like equal carbon intensity (CO₂/GDP)

In more detail:

1. **Equal absolute reductions** per capita would be most regressive in distributional terms and would be logically maybe impossible because low emitters cannot reduce more than they emit.
2. More real are **equal relative reductions** (per capita). It is fundamental for **Kyoto** - for industrialized countries. Anyway it is some form of grandfathering. Although there is the Clean Development Mechanism (CDM) and other emissions trading mechanism within the Kyoto treaty which go a little bit beyond this principle, it does not seem to come in terms with nature on a global scale on this basis because most countries will hardly accept it simply. Anyway this concept implicates some kind of Pareto optimality; the ranking will stay the same.
There is criticism that policy instruments such as tradable emissions quotas, carbon taxes and “joint Implementation” may well serve to make matters worse unless they are properly referenced to targets and time-tables for equitable emissions reductions overall.³⁶
3. A proposal widespread in developing countries is to give the license to pollute a certain amount. This is some rationing (of energy use). If someone pollutes less she can get a reward for good behaviour, the “ration card” can be traded. The unit could be

³⁵ O’Brien K., Leichenko R. (2006): Climate Change, Equity and Human Security. Die Erde 137 2006 (3), p. 168

³⁶ Christian Aid (2000) p. 19

practically the state so this principle of **equal quantity per capita in spatial terms for future emissions from now** on or from a certain date

Practically it would be some contraction and convergence. This is the official position of the non-aligned group of developing countries and is backed by all of Africa, India and China. A resolution of the European Parliament also adopted convergence to an equitable distribution of emissions rights on a per capita basis by an agreed date in the this century,³⁷ but without concrete date.

4. But this has been only the beginning: If we don't take the territories of countries as essential units of production and emission but look on the domination of flows of goods and materials and look on the impacts of consumption by taking into account FOR WHOM - and not where – production and emissions take place then the often celebrated dematerialisation³⁸ in the industrialized countries loses ground because a great part of emission intensive extraction and basic production of products for industrialized countries is done in developing countries.

So the “ecological debt” increases by “ecological unequal exchange”³⁹ and often there is some type of “lock in” in this status for the developing countries because it is hard to afford investments for alternative paths.⁴⁰

Here we call this principle: **Equal quantity per capita for future emissions from now on – in functional terms**. It would be some common “polluter pays principle” which is generally accepted also by the OECD.

Generally in a systemic consideration causation is not so simple to identify as it seems at the first look. Therefore and because of many methodological problems in contrary to the former principle the practical calculation will meet many difficulties - additionally to the process of acceptance by industrialized countries. But such an accounting is conceivable at least for the presence.

5. The above reasoning about the Brazil proposal, the MATCH-process and world-system approach corresponds to the **concept of equal quantity per capita considering (all) historic emissions – first in spatial terms**.

By this concept a lot of (but not all) former economical and ecological global distributional asymmetries are focused, and in result does not indicate a comfortable situation for the industrialized countries: A “calculation shows an enormous debt owed by the industrialised G7 countries, to the less, and especially the group of heavily indebted poor countries. An amount increasing day by day. If we were project backward to the year 1860, the date from which officially recognised figures are available, the debt owed by rich countries would be astronomical.”⁴¹ Anyway this “carbon debt” hits poor countries first and worst in the climate change because like foreign debt generally undermines the capacity in investment in infrastructure, health and education in least developed countries.

³⁷ Roberts J. T., Parks B. C. (2007): A climate of injustice: global inequality and climate change – vulnerability; responsibility and action. MIT Press. P 144f

³⁸ Roberts J. T., Parks B. C. (2007): A climate of injustice: global inequality and climate change – vulnerability; responsibility and action. MIT Press. P 164

³⁹ See for example Martinez-Alier J. (2004) : The Environmentalism of the Poor – A Study of Ecological Conflicts and Valuation. Oxford University Press

⁴⁰ Roberts J. T., Parks B. C. (2007): A climate of injustice: global inequality and climate change – vulnerability; responsibility and action. MIT Press. P 166

⁴¹ Christian Aid (2000) p. 9

If we look to the past basically it is arguable also to integrate future. If we do so first the definition of the end-date of the considered time-frame is a very sensible (political) decision because it is very sensitive to results. The historic distribution of contribution to stocks of harmful substances responsible for climate change more or less is known or defined, but the form of sharing the “rest” till a converging benchmark depends strongly on the future time horizon and various assumptions of regionally differentiated development. In a somehow converging scenario defining the end-date of the considered time-frame near from now would decrease the accountable share of the north per capita. But choosing long horizons in the future (e.g. 100 years) would probably decrease significantly future shares of “early emitters”; in connection with a late historical time frame in the past maybe even to an “average” number - without possible distributional obligations. Therefore especially some US-institutions prefer a time-frame with a late beginning a late ending.

For weakening the contribution of “early polluters” via non-linearities it is argued that countries “developing at a later period ca profit from developments in other countries and are therefore likely to have a lower contribution to climate change”. But although these effects of more efficient technology for late polluters is right there could be described opposite arguments of vicious circles by (earlier) domination with long lasting negative effects within the world system view.

But evidently the inclusion of future emissions would be based on prognoses, which are uncertain per definition especially for the long run. More fundamentally accepting the integrating the future in accounting the responsibility for emissions could – elegantly - erase uncomfortable consequences for industrialized countries per definition.

6. And this has not been the end. Analogously to above we can consider a concept of **equal quantity per capita considering (all) historic emissions – in functional terms**. If not a territorial concept would be the basic for calculations but a functional the setting even could be worse for OECD-countries. When calculations would be made on the principle who commands production (with the impact of emissions) and who is profiting from production (with the impact of emissions) then historically and actually the relations would change not in favour of OECD. Although complicated this concept is conceivable roughly– with high effort.

It is not trivial for industrialized countries to accept the historical view, and so it is for the functional view. But if e. g. emissions based on FDI and Production for export are accounted not for the north what about “property rights”? do they only belong to profits, not to emissions?

7. Finally another sort of concept focus on “**efficiency**”-**targets** like equal carbon intensity (CO_2/GDP). In this concept every man has the right to use resources in an equal form of efficiency. This view is adopted by the Bush-administration⁴². It implicates well-known measurement problems of GDP, which generally favour more developed countries.

Assumed the environmental Kuznets-curve – a relation of emissions and GDP in the form of a inverted U – is right then newly industrialising countries (emerging nations) would worse off because their CO_2/GDP is relatively bad if we consider spatial terms and not functional terms.

⁴² Roberts J. T., Parks B. C. (2007): A climate of injustice: global inequality and climate change – vulnerability; responsibility and action. MIT Press. P 142f

150 years emission moratorium for the USA (50 years for the EU) to reach a just share?

An hypothetical example: In the USA some (now) 5 % (300 millions) of the world population have been responsible for roughly 20% emissions till now (if only CO₂ is considered it would be much more as mentioned). If we assume that in the future there will be the same amount of entire global emission like in last 50 years and the USA would emit zero as long as the cannot reach their “just” (world average) share on the total amount of historical global emissions – the USA would have to stay around 150 years in the status of zero-emission to reach the 5 % emission share. – In analogy for Europe this Zero-emission status would be some 50 years.

But the calculation on the basis of nations does not regard the unequal intra-nation disparities – as mentioned. Without supplement it could foster nation confrontation along inadequate frontlines. For - roughly - the lifestyles of a smaller part of population in the developing countries und certainly big share in OECD-countries are similar and have similar implications on energy consumption and emission of harmful substances.

Because a strict moratorium is hypothetical some global regulations on far-reaching compensations are realistic solutions for which still much socio-economic and socio-ecologic research is to be done.

Other factors besides emissions will be relevant for concrete solutions. For instance natural resource endowments or higher heating bills because of geography probably are relevant. But there will be needed some objective foundations.

Pareto optimal sinking in the climate change or redistribution

The Stern Review accepted: “Climate change is the greatest market failure the world has ever seen”⁴³ But would it be then sufficient to propose still more “market” solutions ? The former French president this year proposed a “revolution” in energy affairs because of climate change. What kinds of revolution will be on the agenda?⁴⁴

The huge global challenges by the impacts of climate change seem to be similar to the threat of destruction by nuclear war. Anyway (new) tremendous inequities can be seen, and the **question of global (re)distribution now evidently seems to be inseparably intertwined with the possibility of feasible solutions for the climate change issue.** So the importance of global distribution of income, wealth and consumption never was so central for ecological issues. More: **The tough interrelation between distribution and the future of the planet seems to be a completely new situation for mankind.**

The emerging “climate justice” movement probably will become much more important in this context. The questions of property on land, resources and environmental space will be seen in a new context, in the end the property rights on capital, the extent and democratic form of regulation and planning, too.

⁴³ Stern Review p viii

⁴⁴ Altvater E. (2005): Das Ende des Kapitalismus, wie wir ihn kennen, Münster (Altvater Elmar (2005) [The end of capitalism as we know it]. Muenster. Germany

Within the concept of Pareto optimality it is not allowed to decrease the utility/income position of any person for the aim of the improvement of another, a redistribution of wealth and assets so would be “inefficient”. But the economics of climate change seems to show the intrinsic interrelation of the necessity of global socio-economic convergence and mitigation of climate change. So climate change also fundamentally changed the circumstances of global distribution and redistribution in a very asymmetric world.

Obviously we can choose⁴⁵ sinking Pareto optimally in the climate change or to overcome an asymmetric world and forestall worst implications of climate change by convergent redistribution. In relation to realistic alternative paths without strong mitigation of climate change the redistribution option is a win-win strategy and probably the only.

Literature:

- Adger W.N., J. Paavola, S. Hug and M. j. Mace (eds.) (2006): *Fairness in Adaptation to Climate Change*. – Cambridge, Mass.
- Agyeman J., R. D. Bullard and B. Evans (eds.) (2003): *Just Sustainabilities: Development in an Unequal World*. – Cambridge, Mass
- Altvater E. (2005): *Das Ende des Kapitalismus, wie wir ihn kennen*, Münster (Altvater Elmar (2005) [The end of capitalism as we know it]. Muenster. Germany
- Amin, S., Arrighi, G., Frank, A. G., Wallerstein, I. (1990): *Transforming the Revolution. Social Movements and the World System*. New York. Monthly Review Press.
- Arrighi, G. (1994). *The Long Twentieth Century. Money, Power and the Origins of Our Times*. London.
- Athanasiou T. and P. Baer (2002): *Dead Heat: Global Justice and Global Warming*. – New York
- Baer P., Harte J., Haya B., Herzog A. V., Holdren J., Hultman N. E., Kammen D. M., Norgaard R. B. and Raymond L. (2000): *Equity and Greenhouse Gas Responsibility*. – Science 289:
- Bohle H.-G., O'Brien K. (2006): *The Discourse on Human Security: Implications and Relevance for Climate Change Research*. A Review Article. *Die Erde* 137 (2006) (3), pp. 155-163
- Burns, Thomas J., Byron L. Davis, Kick E. (1997). "Position in the World-System and National Emissions of Greenhouse Gases." *Journal of World-Systems Research* 3: 432 - 466.
- Campos C. P., Muylaert M. S., Rosa L.P., 2005: "Historical CO₂ emission and concentrations due to land use change of croplands and pastures by country", *Science of the Total Environment* 246, 1-3, pp 149-155
- Cedric, Ph. (2003): *Discounting the Future*; http://www.ecoeco.org/publica/encyc_entries/philibert.pdf
- Chao H., Peck S., 1998, Pareto optimal environment control and income distribution with global climate change. Discussion paper, electric Power Research Institute, Palo Alto
- Christian Aid (2000): *Who owes who – climate change, dept, equity and survival* <http://www.christian-aid.org.uk/indepth/9909whoo/whoo2.htm>
- Cutter S. (1995): *Race, Class and Environment Justice*. – *Progress in Human Geography* 19: pp107-118
- den Elzen M. G. J., et al (2005) : *Analysing countries' contribution to climate change: scientific and policy-related choices*, *Environmental Science & Policy, Volume 8, Issue 6* , December 2005, Pages 614-636
- den Elzen M. G. J., Schaeffer M. (2002): "Responsibility for past and future global warming: Uncertainties in attributing anthropogenic climate change", *Climatic Change* 54, pp 29-73
- den Elzen M. G. J., Schaeffer M. , Lucas P.L. (2004): *Differentiating future commitments on the basis of countries' relative historical responsibility for climate change: uncertainties in the 'Brazilian Proposal' in the context of a policy implementation*, *Climatic Change Vol 71 Nr 3 pp 277-301*
- [FCCC/AGBM/1997/MISC.1/Add.3](http://www.fccc.org/public/1997/MISC.1/Add.3)
- Fernand Braudel Centre for the Study of Economies, Historical Systems, and Civilizations: <http://www.binghamton.edu/fbc/>
- Frey T., Schiedt H.-U. (2005): *Wie viel Arbeitszeit kostet die Freizeitmobilität? – Monetäre Reisekosten in der Schweiz 1950-1910*, In Gilomen H.-J., Schumacher B., Tissot L. (Hg.): *Freizeit und Vergnügen vom 14. bis zum 20. Jahrhundert*, Chronos, pp 157-171
- Hanappi H., Hanappi-Egger E., (2003): *Elements of an I-O-based Framework for Marxian, Feminist and World-System Approaches*, in: Kohler G. and Chaves E. (eds), *Globalization: Critical Perspectives*, Nova Science Publishers, New York
- Höhne N., Harnisch J. (2004): *Calculating historical contributions to climate change – discussing the 'Brazilian Proposal'*, *Climatic Change*

⁴⁵ There is a bulk of literature in this sense. For example: Chao H., Peck S., 1998, Pareto optimal environment control and income distribution with global climate change. Discussion paper, electric Power Research Institute, Palo Alto

- Höhne N., Blok K. (2005): Calculating historical contributions to climate change – discussing the ‘Brazilian Proposal’, *Climatic Change*
- Ikeme J. (2003): Equity, Environmental Justice and Sustainability: Incomplete Approaches in Climate Change Politics. – *Global Environmental Change* 13: pp195-206
- Kammen D., Kinzing A. (1998): Aiming for equity, *Tiempo*, No 29, September 1998, International Institute for Environment and Development, and University of East Anglia
- Kromp-Kolb H., Formayer H. (2005): *Schwarzbuch Klimawandel*, ecowin, Salzburg
- MATCH (= Ad hoc Group Modelling and assessment of contributions to climate change): UNFCCC Overview status 2002 - Report of the expert meeting <http://unfccc.int/resource/docs/2002/sbsta/inf14.pdf>
http://unfccc.int/methods_and_science/other_methodological_issues/items/1038.php
<http://unfccc.int/resource/brazil/meet080903/pres080903.html>
http://unfccc.int/resource/brazil/meet080903/present/nik_hoh1.pdf
<http://www.match-info.net/> Presentation 7 May 2006 MATCH-Paper 1
<http://unfccc.int/2860.php>
- Xiaosu Dai, Michel den Elzen, Höhne N. (2004)
[Ad hoc group for the modelling and assessment of contributions of climate change \(MATCH\)](http://www.match-info.net)
<http://www.match-info.net>
- Martinez-Alier J. (2004) : *The Environmentalism of the Poor – A Study of Ecological Conflicts and Valuation*. Oxford University Press
- Müller B. (2002): *Equity in Climate Change: The Great Divide*. – Oxford
- Muylaert M. S., Cohen C., Rosa L.P, Pereira, 2004: “Equity, responsibility and climate change” *Climate Research* 28, 1
- Muylaert M.S., Campos C.P., Rosa L.P. (2007): “GHG historical contribution by sectors, sustainable development and equity” *Renewable and Sustainable Energy Reviews* V. 11 issue5, p. 988-997, 2007.
- O’Brien K., Leichenko R. (2006): *Climate Change, Equity and Human Security*. *Die Erde* 137 2006 (3), pp. 165-179
- O’Connor J. (1988): *The Second Contradiction of Capitalism, Natural Causes, Essays in Ecological Marxism*, New York
- Pettit J. (2004): *Climate Justice: A New Social Movement for Atmospheric Rights*. – *IDS Bulletin* 35 (3): 102-106
- Podobnik B. (2002): *Global Energy Inequalities: Exploring the Long-term Implications*. *Journal of World-Systems research*, VIII, 2, spring 2002, 252-274
- Roberts J. T. (1999): “Extending the World-system to the Whole System: Towards a Political Economy of the Biosphere.” J. Timmons Roberts and Peter E. Grimes. P. 59-83 in *The Global Environment and the World-System*. Greenwood Press. Walter Goldfrank. David Goodman, an Andrew Szasz, editors.
- Roberts J. T., Parks B. C. (2007): *A climate of injustice: global inequality and climate change – vulnerability; responsibility and action*. MIT Press
- Rosa L.P, Ribeiro S. K., (2001): The present, past, and future contributions to global warming of CO₂ emissions from fuels, *Climatic Change* 48, Nr 2-3
- Rosa L.P, Ribeiro S. K., Muylaert M.S., Campos C.P, 2004: “Comments on the Brazilian Proposal and contributions to global temperature increase with different climate responses - CO₂ emissions due to fossil fuels, CO₂ emissions due to land use change”, *Energy Policy* V. 32, 13, pp 1499-1510
- Rose A., Kverndokk S. (1999): *Equity in Environmental Policy with an Application to Global Warming*. – In: van den Bergh, J. C. J. M. (ed.): *Handbook in Environmental and Resource Economics*. – Cheltenham: 353-379
- Steininger K., Gobiet W. (2005): *Technologien und Wirkungen von Pkw-Road Pricing im Vergleich*, Wegener Center Graz Bericht 1/2005
- Stern Review: *The Economics of Climate Change* (2006)
www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm
- Trudinger C., Enting J.(2005): Comparison of formalisms for attributing responsibility for climate change: Non-linearities in the Brazilian Proposal approach, *Climatic Change* 68, Nr.1-2
- UN Climate Change Conference - Nairobi, 6 - 17 November 2006
- VCÖ (7.3.2007): *Frauen sind klimafreundlicher mobil als Männer!* Vienna
- Wallerstein I. (1974,1980, 1989): *The modern world system*”, 3 volumes