

**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](mailto:baum.josef@utanet.at)

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

### **Abstract**

The burden sharing of mitigation on climate change could be the big issue of future extreme global conflicts. Within the Kyoto process Brazil made a proposal to set differentiated emission reduction targets according to the impact of their historic emissions. An international group of researcher now can present results. The historical world–system approach combines asymmetric accumulation of capital and harmful substances. Equity concepts for burden sharing are presented. The central question: Should the former distribution of emissions, the accumulated stock of harmful substances be considered or not? Should former emission activities account for future burden sharing? Accepting equal rights and equal quantity per capita considering all historic emissions there could be extreme consequences for “early polluters”.

An hypothetical example: In the USA some (now) 5 % (300 millions) of world population have been responsible for roughly 20% emissions till now (if only CO<sub>2</sub> is considered it would be much more). 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 - they would have to stay 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.

Within the concept of Pareto optimality it is not allowed to decrease the utility/income position of any person. A redistribution of wealth and assets 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. And so the climate change also fundamentally changed the circumstances of global distribution and redistribution in our very asymmetric world.

Obviously we can choose sinking Pareto optimally in the climate change or to overcome an asymmetric world and worst implications of climate change by convergent redistribution.

## **PROVISIONAL PAPER**

### **The future big issue**

There are many signs that climate change still accelerates, the awareness to start fundamental measures<sup>1</sup> but there are not adequate policy on the large scale, see UN Climate Change Conference - Nairobi, 6 - 17 November 2006<sup>2</sup>

The time to mitigate the climate change seriously will come - maybe just after very unpleasant events. The burden sharing of the tremendous and rising currently necessary mitigation activities on climate change will be the topic of still very many conferences in the next decades, and the big issue of future extreme global conflicts; maybe THE big issue.

### **The “Brazil proposal” and institutional aftermaths (MATCH)**

This issue is indicated generally in many publications<sup>3</sup>. Since some years there is a political and scientific process in this direction on a low level:

As part of the negotiations on the Kyoto Protocol, the delegation of Brazil made a proposal<sup>4</sup>, in May 1997, to set differentiated emission reduction targets for parties according to the impact of their historic emissions on temperature rise.<sup>5</sup> This initiated meetings of experts<sup>6</sup> 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 methodological assessment<sup>7</sup> of contributions to climate change should be clarified. After Some meetings<sup>8</sup> the research converged to the first joint paper 2004 (Mainly by researchers from industrialised countries but also with some from developing countries)<sup>9</sup>. The process is documented to a large degree<sup>10</sup>. Now this activities seems to be in the status of refinement<sup>11</sup>. At the end of 2007 there should be a final report, 2008 opinions of governments shall be discussed.

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<sup>1</sup> See the fact that the Stern-report is discussed broadly (although having much methodological problems [www.hm-treasury.gov.uk/independent\\_reviews/stern\\_review\\_economics\\_climate\\_change/stern\\_review\\_report.cfm](http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm)

<sup>2</sup> <http://unfccc.int/2860.php>

<sup>3</sup> 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

<sup>4</sup> Information on the Brazilian Proposal:

[http://unfccc.int/methods\\_and\\_science/other\\_methodological\\_issues/items/1038.php](http://unfccc.int/methods_and_science/other_methodological_issues/items/1038.php)

<sup>5</sup> [FCCC/AGBM/1997/MISC.1/Add.3](http://unfccc.int/methods_and_science/other_methodological_issues/items/1038.php)

<sup>6</sup> Report of the expert meeting: UNFCCC Overview status 2002

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

<sup>7</sup> [http://unfccc.int/methods\\_and\\_science/other\\_methodological\\_issues/items/1038.php](http://unfccc.int/methods_and_science/other_methodological_issues/items/1038.php)

<sup>8</sup> 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](http://unfccc.int/resource/brazil/meet080903/present/nik_hoh1.pdf)

<sup>9</sup> Xiaosu Dai, Michel den Elzen, Niklas Höhne (2004)

[Ad hoc group for the modelling and assessment of contributions of climate change \(MATCH\)](http://www.match-info.net)

<sup>10</sup> See: <http://www.match-info.net>

<sup>11</sup> <http://www.match-info.net> Presentation 7 May 2006 MATCH-Paper 1

Anyway there has been still a lot of spin-off literature<sup>12</sup>.

## A lot of methodological problems

The aim of MATCH is to provide clear guidance on the implications of the use of the different scientific methods, models, and methodological choices.

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.

Policy choices refer to parameters of which the values can not be based on objective 'scientific' arguments alone.

First the choice of indicators for the measurement of global warming e. g. by

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- Pinguelli & Kahn (2001): The present, past, and future contributions to global warming of CO<sub>2</sub> emissions from fuels, *Climatic Change*
- den Elzen and Schaeffer (2002): Responsibility for past and future global warming: Uncertainties in attributing anthropogenic climate change, *Climatic Change*
- den Elzen, Schaeffer 2002: "Responsibility for past and future global warming: Uncertainties in attributing anthropogenic climate change", *Climatic Change*
- Andronova, Schlesinger 2004: "Importance of Sulfate Aerosol in Evaluating the Relative Contributions of Regional Emissions to the Historical Global Temperature Change", *Adaptation and Mitigation Strategies for Global Change*
- Pinguelli Rosa, Ribeiro, Muylaert, Campos, 2004: "Comments on the Brazilian Proposal and contributions to global temperature increase with different climate responses - CO<sub>2</sub> emissions due to fossil fuels, CO<sub>2</sub> emissions due to land use change", *Energy Policy*
- Muylaert, Cohen, Pinguelli Rosa, Pereira, 2004: "Equity, responsibility and climate change" *Climate Research*
- Trudinger & Enting (2004): Comparison of formalisms for attributing responsibility for climate change: Non-linearities in the Brazilian Proposal approach, *Climatic Change*
- Andronova and Schlesinger (2004): Importance of sulfate aerosol in evaluating the relative contributions of regional emissions to the historical global temperature change attribution methods, *Mitigation and Adaptation Strategies for Global Change*
- den Elzen, Schaeffer and Lucas (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*
- Pinguelli, Kahn, Muylaert and Pires de Campos (2004): Comments on the Brazilian Proposal and contributions to global temperature increase with different climate responses—CO<sub>2</sub> emissions due to fossil fuels, CO<sub>2</sub> emissions due to land use change, *Energy Policy*
- Höhne and Harnisch (2004): Calculating historical contributions to climate change – discussing the 'Brazilian Proposal', *Climatic Change*
- Muylaert, Campos, Pinguelli Rosa, 2005: "GHG historical contribution by sectors, sustainable development and equity" *Renewable and Sustainable Energy Reviews*
- Campos, Muylaert, Pinguelli Rosa, 2005: "Historical CO<sub>2</sub> emission and concentrations due to land use change of croplands and pastures by country", *Science of the Total Environment*
- Trudinger, Enting, 2005: "Comparison of formalisms for attributing responsibility for climate change: Non-linearities in the Brazilian Proposal approach", *Climatic Change*
- den Elzen, Schaeffer, Lucas, 2005: "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*
- 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
- Rive, Torvanger, Fuglestad 2005: "Climate agreements based on responsibility for global warming: periodic updating, policy choices, and regional costs", *Global Environmental Change*
- Höhne, Blok, 2005: "Calculating historical contributions to climate change – discussing the 'Brazilian Proposal'", *Climatic Change*

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

Some further choices are analysed: The considered mixture of greenhouse gases Complicated. Anyway CO2 is lead substance. The inclusion and relevance of methane is very sensible in the distribution of contributions of regions. The use of greenhouse warming potentials (GWP) cumulative weighted emissions is an important option.

Scientific choices are

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

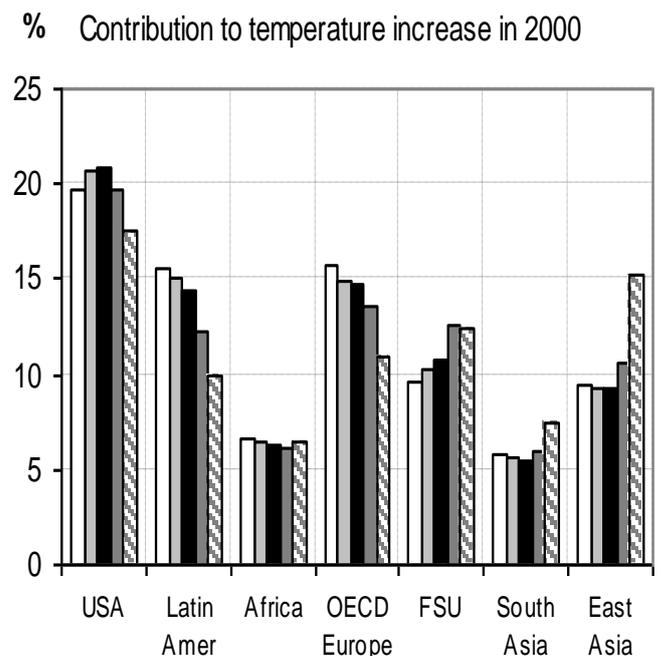
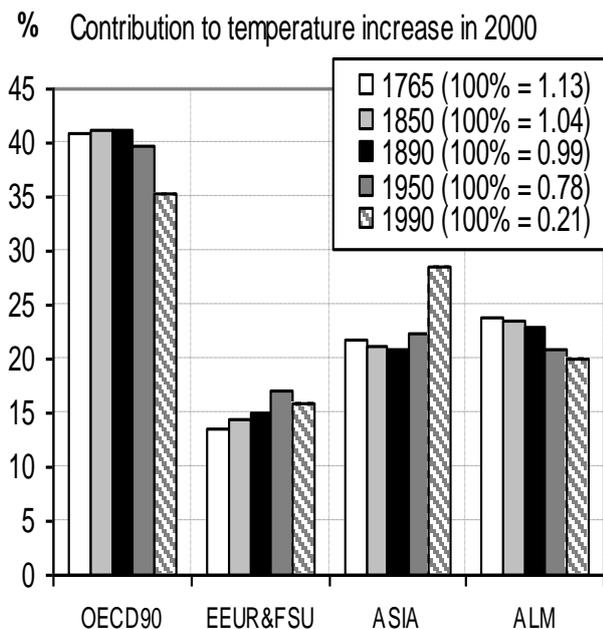
Some assumptions in the removal of CO2 by the land use have to be made.

The most relevant and exclusively 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.<sup>13</sup>

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.

### Main conclusions of MATCH



<sup>13</sup> This concept is very remarkable because its logic contradicts the general time-increasing value at discounting

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

MATCH paper 1: contributions to climate change, SB-23 17 May 2006<sup>14</sup>

These are not per capita values but relative global shares

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<sup>14</sup> <http://www.match-info.net/> Presentation 7 May 2006 MATCH-Paper 1

Two main factors influence results regional distributions of 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 CO<sub>2</sub> emissions (long residence time) and their small share of methane emissions (short residence time)

So main results of one group of MATCH-researchers are for example:

“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 CO<sub>2</sub> 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”<sup>15</sup>.

### **Most sensible implications**

The aim of MATCH “only” is to calculate various of calculations of regional distributions of contributions to global warming. So far – in this article – we reported.

If the option of historical calculation then is preferred the real critical questions arise with far-reaching conclusions:

- What pattern of global distribution in reducing rates on emission should be achieved?
- Which concepts of equity have to be used?
- What are equal rights to the atmospheric commons (the global capacity to absorb carbon is a depletable resource)?
- **The central question: Should the former distribution of emissions, the accumulated stock of harmful substances be considered or not? Should former emission activities account for future burden sharing?**

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

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<sup>15</sup> 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

*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. When the other is also returning home the meal is eaten for 60 %. Now they dispute about the belonging of the rest of the meal. There are at least 3 different notions of equity.*

- 1. The one said: "I am accustomed to eat much, your are accustomed to eat only a snack, so it is just and efficient to divide the rest 5:1 ("Grandfathering", the US-Bush-solution<sup>16</sup>),*
- 2. but I will reduce a little bit, and you can even double. Let's make 4:2 (Kyoto)*
- 3. The man coming late said: it's very complicated. Lets make a simple rule: Everyone gets the same share – of the rest (3:3). This is very generous of the late coming (Opinion of G-77 block)*
- 4. An observer could say: the one has eaten much. Everyone gets the same share – of the entire meal. So they should divide 1:5*

### **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 excellent framework for analyzing global issues<sup>17</sup>: 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 analyzing the main processes it is important to consider the historical tendencies of the last 500 or at least 200 years.
- By explaining core, semicore 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 vision
- The theory is dynamic with open end

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.<sup>18</sup>

E. g.: "In examining the social concomitants of greenhouse gas emissions, we find that CO<sub>2</sub> production is most closely associated with the core position in the world–system, and that

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<sup>16</sup> The US-government has made ratification of the Kyoto Protocol conditional on "meaningful participation" by developing countries. Science vol. 289, 29 September 2000

<sup>17</sup> 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/>

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.”<sup>19</sup>.

### ***Integrating intergenerational and intragenerational distribution by an IO-framework***

In the sense of world-system approach I do work on a world model integrating ecological and economic issues. Hardy Hanappi (2003)<sup>20</sup> wrote a basic paper on an input-output-based framework integrating gender and world-system approaches to labour value theory. I 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 absolute relevantly. 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.<sup>21</sup>

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

- classes,
- regions (space)<sup>22</sup>, and
- gender.

This is extended by *intergenerational* distribution on the time axis.

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 core 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.

By combining different economic and ecological input-output-levels 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 or to a combination of both. Here only roughly some basic concepts are noticed. Real concepts could be combinations of types.

Global greenhouse gas emission could be achieved by

- Equal absolute reductions per capita (probably impossible)
- Equal relative reductions per capita
- Equal quantity per capita for future emissions
- Equal quantity per capita considering all historic emissions

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<sup>19</sup> 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.

<sup>20</sup> 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

<sup>21</sup> There is much literature on this

<sup>22</sup> Amin S., 1978, *The Law of Value and Historical Capitalism*, Monthly Review Press

For the version – preferred here in the sense of world–system approach - the sensible decision is the definition of the end-date of the considered time-frame. 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” depends strongly on the future time horizon. Defining the end-date of the considered time-frame near from now would mean minimizing future shares of “early emitters”, maybe even to zero when the historical share of up-to-date emitting (for example for the USA)

An hypothetical example: In the USA some (now) 5 % (300 millions) of world population have been responsible for roughly 20% emissions till now (if only CO<sub>2</sub> is considered it would be much more). 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 - they would have to stay 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 setting even could be worse for OECD-countries: If not a territorial concept would be the basis for calculations but the otherwise very liked property rights. 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 such an accounting is conceivable at least for the presence.

Furthermore the calculation on the basis of nations does not regard the unequal intra-nation disparities and can foster nation confrontation although - roughly the lifestyles of a smaller part of population in the developing countries und certainly bigger share in OECD-countries are similar and have similar implications on energy consumption and emission of harmful substances

For concrete solutions other factors besides emissions like natural resource endowments probably will be relevant

### **Pareto optimal<sup>23</sup> sinking in the climate change or redistribution**

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Obviously we can choose<sup>24</sup> sinking Pareto optimally in the climate change or to overcome an asymmetric world and worst implications of climate change by convergent redistribution.

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<sup>23</sup> 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

<sup>24</sup> 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

