The global carbon budget: a conflicting claims problem

According to the fifth assessment report of IPCC (IPCC, 2013), in an overwhelming consensus of the international scientific community, warming of the climate system is unequivocal, and such a fact might involve damaging effects and potentially irreversible impacts on ecosystems with profound implications for human societies. In accordance to climate models, most countries have adopted as a guardrail not exceeding the limit of 2oC relative to pre-industrial levels. Not exceeding such limit avoids abrupt climate changes that entail what has been assumed as dangerous climate change.

Recent research suggests that limiting global cumulative CO2 to 1440Gt over the period 2000-2050 yields a 50% probability of warming exceeding the 2oC (Meinshausen et al., 2009); i.e. a global carbon budget. However, according to future pathways of cumulative CO2 projected by the International Panel of Climate Change (IPCC,2000), considering alternative scenarios in terms of population, economic growth or technological trends, the World will reach from 1758 to 2736Gt of cumulative CO2 by 2050 (depending on the specific scenario considered). This puts environmental global governance in a situation of bankruptcy; countries claim more cumulative emissions (1758-2736Gt) by 2050 than actually available (1000Gt to only have 50% chance). This paper main goal is to propose an allocation of the global carbon budget as a classical conflicting claims problem.

The international community has repeatedly tried to achieve environmental agreements to reduce CO2 concentration in the atmosphere (UNFCC in 1992, Kyoto 1997, Copenhagen 2009). Nonetheless, CO2 concentration in the atmosphere has continuously increased jointly with the global mean temperature. In this sense, global environmental governance has traditionally tackled global warming in terms of annual CO2 emissions. However, what ultimately determines global temperature raise is cumulative CO2 emissions, this is CO2 concentration in the atmosphere (Perman et al., 2003; Meinshausen et al., 2009; Canadell et al., 2007; Stern, 2007; IPCC, 2013). Reduction of annual CO2 emissions is a necessary but not sufficient condition: climate change is a “stock" environmental problem rather than just a “flow" environmental problem (Perman et al., 2003).

Climate change is the consequence of the raise in the global temperature yielded by the accumulation of CO2 in the atmosphere. Hence, reduction of CO2 flow (annual emissions) must be accompanied of a stock limitation (carbon budget) if climate change wants to be avoided. Therefore, setting a cap in climate policies results a 'sine qua non' condition. Accordingly, IPCC has quantified, for the first time, the global carbon budget in his last fifth assessment report (IPCC 2013). United Kingdom Government (Climate Change Act, 2008) uses carbon budgeting to 2050 to monitor their carbon footprint. They claim that carbon budgeting is a more consistent target with limiting global temperature raise. Besides British carbon budgeting is consistent with EU Emission Trading Scheme.

The research presented in this article proposes a conflicting claims problem treatment of global carbon budget: humanity is facing a situation where different agents (countries or groups) claim (scarce) resources (the carbon budget), such that there is not enough to honor the aggregate claim. Situations like this are known as conflicting claims problems (O'Neill, 1982). A typical example of the framework proposed is how should the money in a bank be distributed among its creditors. Here creditors are represented by emitting countries whose claims are the future cumulative emissions projected by SRES (IPCC 2000): these are the cumulative emissions that would be emitted without commitment nor cooperation. Then, the bank is the atmosphere and the money is the carbon budget that is not enough to satisfy all claims. Particularly, we use the widely accepted Meinshausen et al. (2009) probabilistic model to quantify global carbon budgets for the period 2000-2050. We consider different risk scenarios of exceeding the 2oC limit. The object thus is to allocate a restricted global budget among parties whose claims exceed such budget.

The conflicting claims problems literature has provided different ways (rules) to solve bankruptcy type problems. However, climate change has never been considered from this perspective so far. Furthermore, behind all of the proposed rules, a set of appealing properties (principles) is considered. Consequently, our results assess (i) different rules to distribute the global carbon budget; (ii) different desirable principles that may be required in a climate change context to the proposed rules. Our analysis suggests that the more adequate rule, satisfying all the required principles to deal with conflicting claims problem involved global carbon budget, is the Talmud rule: a division rule that takes its name from the Babylonian Talmud, a compendium of Jewish laws that dates back 1800 years.

Despite the novelty of our approach, there is few close literature; Grasso (2012), for instance, discusses different distributive patterns to distribute an emission budget. Based on an ethical perspective, he discusses whether emissions rights should be allocated in proportion to historical responsibility or to per capita terms, among others. His discussions conclude that the global carbon budget should be allocated according to the survival-luxury emissions principle, i.e. proportionality to countries population only for countries above the threshold of subsistence. Also, Llavador et al. (2013) model a intergenerational North-South world where a sustainable concentration path has already been agreed a priori between both regions and from there, the authors allocate CO2 emissions in terms of growth rates of North and South. Our approach, in contrast, shares motivation but not procedures: our distributional allocation considers the actual conflicting claims perspective; countries through its population, economic growths and technological tendencies (captured by SRES future emissions), claim for an amount of emission's rights above the total emissions budgeted (captured by Meinshausen et al., 2009).

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