

Analyzing Trade-offs in International Climate Policy Options: The Case of the Green Climate Fund

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Summary. — We investigate the trade-offs between economic growth and low carbon targets for developing and developed countries in the period up to 2035. Policy options are evaluated with an original version of the dynamic CGE model GDynE. Abatement costs appear to be strongly detrimental to economic growth for developing countries. We investigate options for reducing these costs that are consistent with the current negotiations. We show that the Green Climate Fund financed through a levy on carbon taxation can benefit all parties, and large benefits are associated with investment of the Green Climate Fund to foster energy efficiency in developing countries. © 2015 Elsevier Ltd. All rights reserved.

Key words — climate change policies, Green Climate Fund, developing countries, dynamic CGE energy model

1. INTRODUCTION

One of the politically most controversial climate change questions is how much will it cost to meet the Greenhouse Gases (GHGs) emission reduction targets that are consistent with a reasonable probability of avoiding major upheavals in the world's climate in the medium to long term? The issues under debate cover several aspects, ranging from the quantification of overall abatement costs to the distribution of these costs across countries (Clarke *et al.*, 2009). With respect to the latter the principle of Common But Differentiated Responsibilities (CBDR), introduced by the United Nations Convention on Climate Change (UNFCCC) and fully adopted by the Kyoto Protocol (KP), has acknowledged different capacities and needs of developed and developing countries, and has proposed a differentiated approach to computing emission reduction efforts. It takes the view that, although addressing climate change is a global challenge, national responsibilities should be differentiated, with developed countries bearing a heavier burden in both reducing emissions and providing resources for adaptation measures than developing countries.

The issue of CBDR is currently being debated as a crucial point in Post-Kyoto negotiations. Developing countries consider it as being based in part on historical responsibility GHGs emissions whereas developed countries emphasize the role of current and future emissions trends. Developing countries are now responsible for more than half of global GHGs emissions (IEA, 2013a) and the projections reveal that the share of GHGs generated in developing countries by 2035 will reach almost 70% of global emissions (Oliver, Janssens-Maenhout, & Peters, 2012). These figures explain why these countries are asked to participate actively in abatement actions by the developed nations.

Starting with the Copenhagen Agreement, the interpretation of CBDR has begun to be softer, reflecting both the developed countries' position, which demands a more stringent abatement effort for major developing economies, and the developing countries' demand for maintaining differentiation in

burden sharing. It is clear that positive outcomes in terms of reducing global warming are likely only if efforts are undertaken by all parties (Brunnée & Streck, 2013).

At the same time, several concerns about the effects of abatement costs in terms of economic growth expectations and equity within and between countries reduce the propensity of developing countries to accept binding constraints on GHGs emissions since they consider them a strong limit to their development prospects (Golub, Markandya, & Marcellino, 2006; Markandya, 2011).

One of the most common physical scenarios refers to a pathway consistent with the goal of limiting the global increase in temperature to 2 °C by limiting concentration of GHGs in the atmosphere to around 450 parts per million (PPM) of CO₂ by 2050. Research on possible impacts of not meeting the 450 PPM target indicates these could be very significant and destabilizing for the world. Nonetheless, with the exception of the European Union (EU), practically no country or region is currently following policies that will lead to a 450 PPM stabilization target.

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One explanation for the absence of such policies in most countries is given by the huge potential costs of undertaking emissions reduction. Economic losses (usually expressed in terms of GDP reduction) vary according to region. In the majority of models currently available, China has costs that are consistently higher than the world average, and many other less developed areas face a substantial reduction in expected economic growth path (Edenhofer *et al.*, 2010; Nordhaus, 2013). Nonetheless, although several different approaches and models have been developed (Barker, Lutz, Meyer, & Pollitt, 2011; Criqui, Mima, & Viguier, 1999; Lutz & Meyer, 2009, 2010), there is still no consensus on the economic impacts associated with mitigation policies in line with the 450 PPM target.

It is in this vein that the present paper wishes to contribute to the discussion by developing a dynamic economic-energy model that can simulate alternative and feasible policy options and that focuses on costs of climate mitigation policies in a global setting. In particular, the model focuses on economic losses potentially faced by developed and developing countries if mitigation policies in line with the 450 PPM target will be implemented. Although vulnerability and adaptation are achieving growing attention, especially for developing countries, there are still several open issues to be debated in terms of mitigation actions, which mainly explain the current deadlock in negotiations.

To this purpose, the Green Climate Fund (GCF) seems to represent the instrument that most developing countries are focusing on in order to reach a consensus in the Post-Kyoto negotiations, which is chosen as the formal mechanism to be included in the dynamic model presented here.

The GCF, when operational, would channel significant financial resources into both adaptation and mitigation, potentially enhancing the development of low-emission technologies in developing countries. The fund tries to solve a number of problems, which include the amount of finance provided by developed countries to developing countries for mitigation and adaptation, and also the mechanisms for raising such finance, the financial instrument used to distribute it and its governance.

During recent Conferences of the Parties (COPs), held in Cancun (2010), Durban (2011), and Warsaw (2013), the GCF has been discussed and envisaged as a unique global fund financed by all nations in different ways to implement climate change mitigation and adaptation measures in those countries in which climate change is expected to have the greatest impact. The GCF (which is part of the UNFCCC) represents the main multilateral financing mechanisms to support climate action in developing countries. It will channel a significant share of financing for adaptation and mitigation, including activities to reduce emissions from deforestation and degradation, and was expected to be fully operational by 2014. Regarding the status of the contributions, at the Cancun conference (2010) a target of 100 billion USD by 2020 was established, with an initial allocation of 30 billion in the period 2010–12 (Lattanzio, 2014). As of March 31, 2014, the total amount of pledges and contributions to the GCF Trust Fund amounted to only around 55 million USD (GCF, 2014).

Some aspects of the GCF require further discussion, such as the participation regime, the inclusion of other stakeholders, the relationship with the COP (currently guiding on eligibility criteria and priorities) and, most importantly, the criteria for gathering and allocating resources (Mattoo & Subramanian, 2012).

To this purpose, the debate focuses on defining feasible criteria for: (i) distributing the burden across those countries

financing the fund (developed countries); (ii) allocating the fund to recipient countries (developing countries) in order to reduce the economic costs arising from mitigation and adaptation actions (Cui, Zhu, Springmann, & Fan, 2014).

With respect to the first criterion, responsibility and capability approaches have been proposed. In particular, historical environmental responsibility in terms of harmful emissions produced and economic capacity to contribute to the fund (measured by economic variables as GDP, GDP per capita or wealth, or alternative metrics as the Human Development Index) have been separately or jointly taken into account (Cui *et al.*, 2014; Dellink *et al.*, 2009; Fussel, 2010).

The second issue is conceivably more complex and involves also noneconomic categories. Broadly speaking, the GCF is expected to be distributed in equal parts for adaptation and mitigation measures (Lattanzio, 2014). The adaptation measures focus on the degree of vulnerability of recipient countries, while the mitigation measures aim to reduce the negative impact of abatement costs on short- and medium-term development paths (Fussel & Klein, 2006; IPCC, 2007, 2013).

With respect to how the GCF could operate in order to reduce negative effects due to mitigation efforts in developing countries, it is only beginning to be debated. This constitutes an important shortcoming in such a global initiative since several development opportunities might arise from a proper investment of GCF resources.

In this paper we consider this gap in the scientific literature as crucial to depicting a clear assessment of alternative policy options and thus helping negotiations escaping from deadlock with respect to CBDR and burden sharing. Specifically we analyze the effects of starting on a path that does not allow the world to exceed 450 PPM equivalent concentrations of GHGs by 2050 and compare it with the impacts of such policies as are necessary to be on track for this target over the period up to 2035. This focus on the medium-term horizon is most relevant for current policy design. In particular the paper:

- (i) Develops a specific version of the CGE dynamic GTAP model with an energy module, known as GDynE (Golub, 2013), which includes the implementation of the GCF as discussed in the Post-Kyoto negotiations among the climate policy options.
- (ii) Explores how the GCF could be reasonably financed and what would be the costs for developed countries to create and sustain it.
- (iii) Models alternative options in terms of how the GCF funds can be invested in developing countries in order to understand if some win-win solutions may help in solving the negotiation deadlock and lead to a reduction in mitigation costs for both developed and developing economies through promoting technological innovation, which will make participation in an agreement more attractive for developing countries.

The rest of the paper is structured as follows: Section 2 lays out a description of the model used, Section 3 presents the simulation design, Section 4 describes the main results, and Section 5 outlines conclusions and policy implications.

2. THE MODEL

(a) *The GDynE model*

The energy version of the GTAP (Global Trade Analysis Project) model developed in a static setting (Burniaux &

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