World Scientific Series on the Economics of Climate Change
Volume 2

Climate Finance

Theory and Practice

Anil Markandya • Ibon Galarraga • Dirk Rübbelke

World Scientific

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Theory and Practice

How is the struggle against climate change financed? *Climate Finance: Theory and Practice* gives an overview of the key debates that have emerged in the field of climate finance, including those concerned with efficiency, equity, justice, and contribution to the public good between developed and developing countries. With the collaboration of internationally renowned experts in the field of climate finance, the authors of this book highlight the importance of climate finance, showing the theoretical aspects that influence it, and some practices that are currently being implemented or have been proposed to finance mitigation and adaptation policies in the developed and developing world.

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edited by Anil Markandya (Basque Centre for Climate Change, Spain), Ibon Galarraga (Basque Centre for Climate Change, Spain) and Dirk Rübbelke (Technische Universität Bergakademie Freiberg, Germany)

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Chapter 1

Challenges in International Climate Finance

Ibon Galarraga, Anil Markandya and Dirk Rübbelke

As long ago as 2010, at the 16th Conference of Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) in Cancun, developed countries formally pledged to mobilize USD 100 billion in international climate financing annually by 2020. These funds were to be channelled towards both mitigation and adaptation projects in developing countries.

Five years later, at the COP 21 in Paris in 2015, it was further agreed that "developed countries intend to continue their existing collective mobilization goal through 2025 in the context of meaningful mitigation actions and transparency on implementation" and, prior to 2025, "a new collective quantified goal" shall be stipulated. The new collective goal must not undercut the 2010 commitment to provide USD 100 billion annually.

A lot of controversy still prevails concerning the more concrete subsequent policy steps, although the Paris deal involves a "Decision" text to give effect to the main "Paris Agreement". There is, for example, still the absence of a clear internationally agreed definition of what counts as climate finance. Furthermore, it is not clear how much individual countries have to contribute, and when.

The disbursement scheme also remains imprecise, for example, concerning the allocation of funds for adaptation projects and mitigation projects. While the latter constitute global public goods [Kaul *et al.*, 1999], this is rarely the case for the former. Although the need for resources for adaptation is recognized in the Paris Agreement, there is no quantified funding target for that component. Yet, one may argue that, as stated in the earlier Cancun Agreement, adaptation "must be addressed with the same priority as mitigation" [UNFCCC, 2011].[1] Thus, it could be assumed that a large share of the USD 100 billion pledge should be dedicated to adaptation support. This perspective could — in turn — be challenged; for example as Schelling [2012] points out: "Eventually (decades from now) aid to the poor may be necessary for their successful adaptation to a changing climate. But the more urgent priority is to reduce carbon emissions where they are rising apace with development." Thus, there is controversy not only concerning the distribution of funds between adaptation and mitigation projects,[2] but also concerning the right timing of specific support alternatives.

These and related controversial aspects associated with climate finance are the focus of the different contributions included in this book. It provides ideas for, and presents research on, a range of approaches to raise, manage and allocate international funds in the climate change context.

The book includes 14 chapters, divided in three parts. The first covers practical issues relating to climate finance: who are the main players, what do they contribute, how political factors affect the allocation of funds and how climate finance structure is evolving? The second provides a more theoretical perspective. Climate

[1] A recent study by Buchner *et al.* [2011] found a split between mitigation and adaptation finance of 95:5. The causes of this mitigation bias in international climate finance has been analyzed by Abadie *et al.* [2013].

[2] There is a growing strand of literature analyzing international transfers taking into account both mitigation and adaptation options, e.g., Buob and Stephan [2013], Schenker and Stephan [2014], Heuson *et al.* [2015] and Pittel and Rübbelke [2015].

finance supports the provision of a global public good (reduction in greenhouse gases), as well as one that is mostly national (adaptation to climate change). The rules for allocation of funds will influence how much of each kind of public good is provided. It is not always the case that the present approaches turn out to be Pareto efficient — i.e., they do not provide a combination of the two goods that cannot be dominated by one in each no one is worse off and some countries are better off. Furthermore, the present system would not be considered as the most equitable by those concerned with the ethical dimensions of the problem. This section looks at the extent of current deviations from an efficient solution and ways in which it could be made more efficient and more equitable. The third part of the book looks at particular tools for appraising investments in climate finance so as to select the options that give the highest combination of benefits in a context of uncertainty.

After this introduction, four chapters are devoted to offering an overview of the current practice in climate finance. The first, by **Román, Ansuategi and Markandya** (Chapter 2) offers an overall review of the state of international climate finance in a very detailed assessment on what is happening in the international arena.

Chapter 3 by **Trabacchi and Buchner** focuses on financing adaptation in the context of the post-Paris climate policy. They acknowledge the difficulties in gathering reliable data and propose improvements in current tracking systems. Their study estimates that during 2013 and 2014 close to USD 25 million had been invested in public adaptation in developing countries.

How the private sector may be engaged in mobilizing climate finance is analyzed in the contribution by **Averchenkova** in Chapter 4. The author argues that low carbon development strategies, Nationally Appropriate Mitigation Actions (NAMAs) and, in the future, the Intended Nationally Determined Contributions (INDCs), will play a central role in redirecting private investment towards climate finance. The public sector can effectively contribute to this with policies to reducing risk, by lowering the cost of capital, enhancing the competitiveness of low-carbon technologies, and building capacity for public-private collaboration in climate finance.

Clapp and Pillay devote Chapter 5 to illustrating the functioning and the role of Green Bonds in the context of climate finance. The Green Bond market is growing fast mainly as a result of the actions of multilateral development banks and, lately, also of corporations and municipalities issuing their own bonds. They discuss the possible application of green bonds to support developing country actions on climate, and present some challenges and opportunities that may arise.

Chapter 6 by **Brumme** looks at the role of critical natural resources in the cost of mitigation technologies. As some of the turbines used in wind energy generation require scarce resources such as rare earth elements, the expansion of wind power technologies may be compromised if the distortions in the markets for these are not reduced. The author discusses measures for making these markets more efficient.

The second part of the book deals with understanding the theoretical basis of climate finance, their impacts and how incentives may work. The first contribution by **Kaul** in Chapter 7 considers climate finance through the lens of the concept of global public goods.

Chapter 8 by **Schenker and Stephan** looks at the role of adaptation funding and shows that positive but smaller than proposed transfers in climate finance may be desirable to achieve Pareto improving situations under the public good character of adaptation funding.

In Chapter 9, **Peters, Schwarze and Topp** look at the post-Kyoto international climate finance regime, unravelling how voluntary sustained finance can be maintained over time overcoming the so-called Bergstrom paradox (i.e., a situation where receiving countries end up worse off as a consequence of conditional climate finance). They find that only those resources devoted to mitigation activities can increase the global efforts in that direction and induce Pareto improvements.

Buchholz, Cornes, Peters and Rübbelke also deal with the Bergstrom paradox in international climate finance in Chapter 10. They show that restricting the scope for offsetting behavior is an

effective way to improving the effectiveness of conditional transfers as an instrument of international climate protection. As the authors argue, the mechanism as proposed by them can also be understood as a compromise between the donor and the recipient countries searching for a solution which splits their gains in a fair way.

Pittel and **Rübbelke** in Chapter 11 look at the effects of international transfers on global mitigation and at the repercussions that these transfers might have on welfare in the transfer-providing and the transfer-receiving countries. In their analysis, the authors distinguish between conditional transfers provided in monetary terms (subsidizing mitigation efforts) and conditional in-kind transfers in the shape of support in adaptation to climate change.

Chapter 12 by **Buchholz, Dippl and Eichenseer** deals with the role of technological transfer in climate policy, which — as an indirect instrument for supporting abatement activities in less-developed countries — serves as a substitute for climate finance in the narrow sense. The authors show that leading behavior by some countries based on green innovation together with a strategy of costless technology transfer proves to be a very effective way of fighting climate change, in particular since only the prospect that other countries make use of the improved technology may create an incentive to engage in "green" Research and Development (R&D).

The final part of the book is composed of two chapters devoted to illustrating the use of applied methodologies to assess climate finance related investments.

The contribution by **Chevallier** and **Goutte** in Chapter 13 illustrates the interactions between the electricity and carbon markets using stochastic models for risk management. These are techniques used in the area of financial econometrics. Their findings show that jump models fit better to explain these risks and help set the right incentives for mitigation in complex carbon and electricity markets such as those in Europe and North America.

In Chapter 14, **Abadie** and **Galarraga** use stochastic modelling for carbon and electricity prices, to illustrate the case of real option techniques to adequately assess irreversible investments

under uncertainty and investment in projects with a risk of default. The chapter shows that uncertainty plays a very important role in investment valuation especially in the case of climate finance investment.

Climate finance is the life blood of actions to reduce future climate impacts and to adapt to those impacts that will occur. This book provides a guide to the main areas of debate on the topic from a political, institutional and economic perspective. It is by no means the last word on the topic, which is fast evolving, but it does lay out the state of the art on the subject.

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