Global Climate Mitigation Finance:
The Determinants of its Provision and Allocation

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Abstract:

In recent years development aid (also commonly referred to as Overseas Development Assistance or ODA) has increasingly been allocated for the mitigation of climate change, often diverting funding from more traditional development purposes such as poverty alleviation. To the author's knowledge no other study identifies the determinants of the increasing provision of official mitigation finance and the patterns of its allocation across 180 developing countries. This PhD thesis includes three empirical studies and a theoretical discussion and seeks to fill this gap in the academic literature. The analysis makes use of fixed-effect, random-effect and two-part models, the institutional analysis and development framework and 1998-2010 Organisation for Economic Co-operation and Development (OECD) Rio Marker project-level data from 23 donors and 180 developing countries.

This research finds that donors' emission levels, CO_2 intensity, commitment to the Kyoto Protocol, political views and domestic environmental spending significantly influence their allocation of mitigation finance and the proportion of their total ODA that they designate to it, and that recipient developing countries' potential for mitigation, such as their environmental assets and emission problems, and their institutional and economic factors affect how mitigation finance is allocated to them. The findings show that donors tend to provide loans to recipients with large emission problems and grants to those with large environmental assets. Across donors, the determinants of mitigation finance tend to be heterogeneous. These findings lead to a discussion whether mitigation finance is a perverse incentive for developing countries' emission mitigation and whether it will permanently remain reliant on ODA. . The overall research gives guidance and reflection of the future of official mitigation finance.

Acknowledgments

During the three years of my doctorate training it has been a privilege to be surrounded by people whose guidance is invaluable and meaningful and whose companionship has been genuinely kind and warm-hearted; in their absence, this intellectual and personal exploration would not have been as pleasant or as mindful as it has been.

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1. CLIMATE MITIGATION FINANCE: MONETARY RELIEF FOR A WARMING AND CROWDED PLANET

1.1. Introduction

Intensifying and unprecedented climate extreme events have promoted the global provision of public financial resources aimed at mitigating the problems they cause. Overseas Development Assistance (ODA), as a form of international development aid which was originally designed to alleviate chronic poverty and improve the welfare of developing country populations, has been increasingly allocated to and used for climate mitigation. In the report of the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2007; 2013), the scientific community stresses that the world's changing climate, caused by anthropogenic interference, i.e. industrial activities, will be disastrous if the world is too late in stabilising greenhouse gases (GHG) emission levels that hold the global temperature increase to below 2°C above preindustrial levels. Existing economic and market systems are not fully compatible with the global need to have economic growth that is environmentally sound and sustainable. These systems also have not been able to immediately respond to finance the enormous global scale of climate action required. In this unprepared situation, donor governments have agreed to allocate part of their foreign aid – more specifically, ODA[1] – as fast-start finance for early action to mitigate climate change.

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[1] The Development Assistance Committee (DAC) defines ODA as those flows to countries and territories on the DAC List of ODA recipients and to multilateral institutions which are (i) ***provided by official agencies***, including state and local governments, or by their executive agencies; and (ii) each transaction of which (a) is administered with the promotion of the ***economic development and***

Allocating part of aid to mitigate climate change has extended its impact beyond national boundaries and territories. Unlike the alleviation of poverty, which mainly focuses on improving the economy and wealth of the populations of individual countries, preventing the exacerbation of climate change results in fewer emissions of GHGs and a global public good, entitlement to the benefits of which belongs not only to the populations of countries receiving aid but also to everyone on the Earth. However, allocating aid to mitigate climate change may have no overall impact if other countries fail to control their own emission levels. There is therefore a degree of uncertainty about whether such action will be effective, unless all countries cooperate and participate.

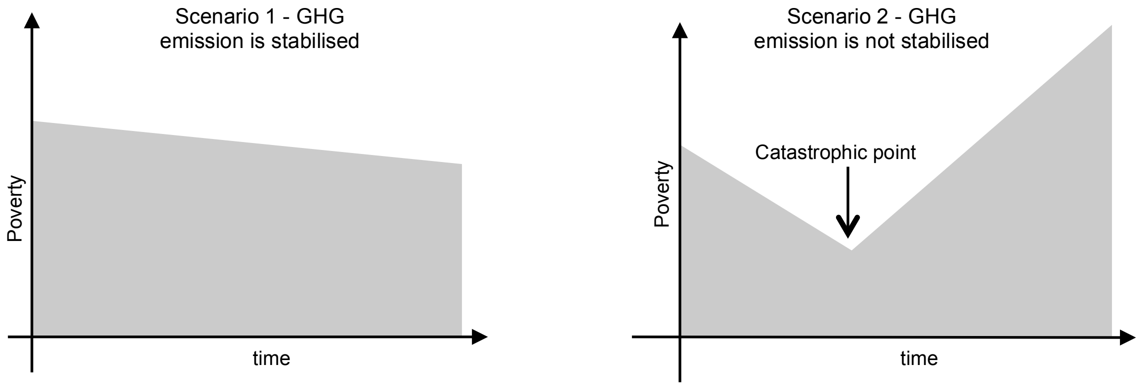
There is some ambiguity about the link between aid allocated for the mitigation of climate change and that for poverty reduction. In current practice, the major share of such aid is used to fund technological advancements in sequestration, promote the use of clean technology and support pilot projects, e.g. for capturing carbon from the air (Sachs, 2009, p. 99) These kinds of projects are unlikely to have much impact on poverty reduction in the short run.

However, despite the competing objectives of emission mitigation and poverty alleviation in the short run (Tol, 2007), mitigating emissions is not a goal that opposes the reduction of poverty in the long run (Halverson & McNeill, 2008, p. 3). Figure 1.1 contrasts two scenarios. In the first, the level of global emissions is stabilised; although development may progress at a slower rate, as indicated by a slower alleviation of poverty, it does so without significant interruption (Stern,

welfare of developing countries as its main objective; and (b) is ***concessional in character*** and conveys a grant element of at least 25 per cent (calculated at a rate of discount of 10 per cent).

2008a). In the second, extreme events such as floods or tsunamis interrupt and destroy development progress and cause more poverty in the long-run. In other words, when allocating development funds, donors are confronted with a dilemma between tackling today's issues and future risk.

Figure 1.1: Two scenarios showing how climate change mitigation affects poverty reduction



With this as an underlying consideration, a case can be made for using part of ODA for the mitigation of climate change. In 2009, the Secretary General of the OECD, Angel Gurria, asserted that ODA has an important role in financing climate action, including mitigation, in the short and medium term until global mechanisms to finance such activity are fully operational (OECD, 2011a). Following his statement, donors committed to providing US$30 billion in climate finance, for both mitigation and adaptation in 2010-2012 (Ciplet *et al.*, 2010). This policy preference and international support increases the permeability of ODA, accelerating the mainstreaming of climate change into the development agenda (Klein *et al*., 2005), and furthermore, merging the development and climate change agendas (Gupta, 2009).

However, despite the urgent need for climate change mitigation, scholars and development practitioners have expressed concern about the potential diversion of ODA from tackling current challenges to stabilising the future climate. Lomborg (2007) acknowledges the anthropogenic cause of climate change but argues that the catastrophic point (as shown in scenario 2 of Figure 1.1) may not necessarily be associated with climate change and is only another natural phenomenon. He therefore emphasises that aid should focus on financing poverty reduction activities such as combating malnutrition, whose social rate of return is higher than preventing further climate change. In a similar vein, Michaelowa and Michaelowa (2007) point out that escalating commitments to fund climate mitigation may divert the objective of ODA from halving world poverty.

Two main reports promote the mitigation strategies of increased energy efficiency and combating deforestation. The Stern Report (Stern, 2008a) shows that one rapid and cost-efficient solution to mitigating emissions is to transform fossil-fuel dependent countries with high economic growth into low-emission, climate-resilient countries. The Eliasch report (Eliasch, 2008) shows that climate finance is able to effectively reduce emissions by reducing deforestation rates and preserving forests as a natural form of global carbon storage. These recommendations imply that funding to mitigate carbon emissions (hereafter 'mitigation finance') is allocated effectively if it is given to developing countries that still rely heavily on fossil fuels and/or have considerable natural carbon storage capacity. However, there is limited understanding of whether countries with these characteristics tend to receive mitigation finance.

Responding to this debate, this research starts with the overarching question:

What are the determinants of the provision and allocation of official development assistance for the mitigation of climate change?

Section 1.2 presents the historical development of mitigation finance and its architecture as background information, while section 1.3 outlines the academic and policy relevance of this study. The setup of the remainder of the thesis, the research questions and the empirical assessment framework used are presented in Section 1.4.

1.2. Mitigation finance: definition, history and architecture

Mitigation finance is part of climate finance. Climate finance is a product of the United Nations Framework Convention on Climate Change (UNFCCC)[2], a formal framework through which all consequent climate change negotiations are administered and regulated. To date, there is no internationally-acknowledged definition of climate finance (Buchner *et al.*, 2011, p. 1). To clarify the definition of climate finance, this section presents several definitions of climate finance and specifies the one that is used in this thesis.

UNFCCC defines climate finance as:

> *… local, national or transnational financing, which may be drawn from public, private and alternative sources of financing. Climate finance is critical to addressing climate change because large-scale investments are required to significantly reduce emissions, notably in sectors that emit large quantities of greenhouse gases. Climate finance is equally important for adaptation, for which significant financial resources will be similarly required to allow countries to adapt to the adverse effects and reduce the impacts of climate change.*

This overarching definition of climate finance includes a broad range of public and private finance with two main objectives: mitigation and adaptation. Unlike

[2] It is one of the three elements adopted at the Rio Earth Summit in 1992. The other two elements that are intrinsically linked are the UN Convention on Biological Diversity and the Convention to Combat Desertification.

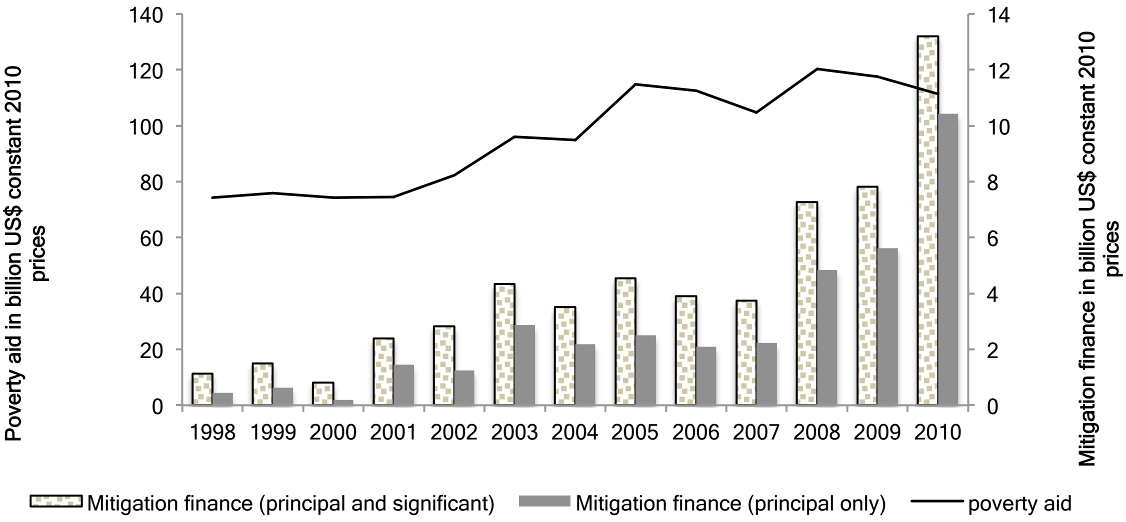
mitigation finance, which funds ex-ante activities to prevent the global climate worsening, adaptation finance funds ex-post activities to help communities and groups to adapt to the negative impacts of climate change.

Climate finance as a whole has to comply with the set of general guiding principles presented in the UNFCCC (hereafter 'the Convention). The Convention states that climate finance should be administered *'[on] the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities'* (UNFCCC, 1992, Art.2).

Responsibility is often interpreted as 'the polluter' being responsible for and paying to mitigate its emissions. This implies that both developed and developing countries are responsible, although it does not specify whether the responsibility includes historical cumulative emissions. Climate finance received little attention until the 2008 Conference of Parties (COP) 13 in Bali that resulted in the Bali Action Plan, which states that 'funding must be adequate, predictable, and sustainable as well as new and additional' (Art. 1(e)(i)). This is echoed in the Cancun Agreements; paragraph 97 on long-term finance states that 'scaled-up, new and additional, predictable and adequate funding shall be provided to developing country Parties' (UNFCCC, 2011a).

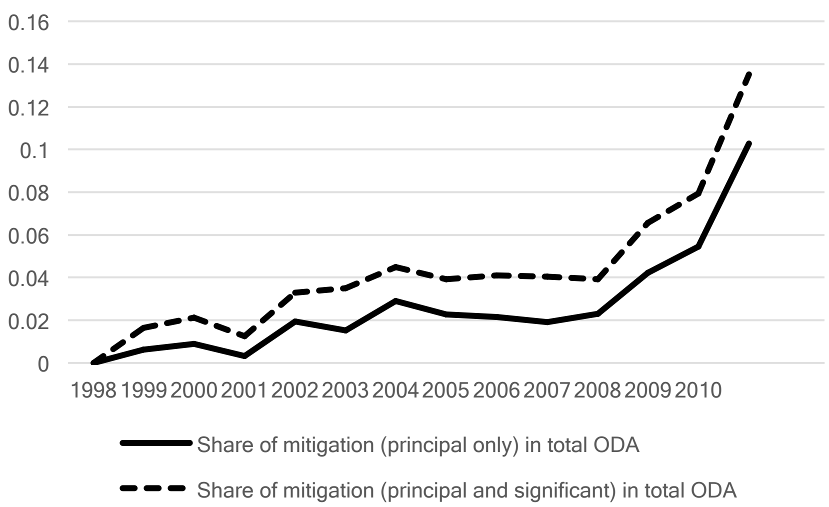
Respective capability is associated with the level of wealth of each country and national economic and development performance. *New and additional* is understood as funding in addition to the existing target of 0.7% ODA from Gross National Income (GNI). This 0.7% target is set to maintain the focus of ODA on alleviating poverty. However, most developed countries have not fulfilled the 0.7% target and in the absence of a cap on how much ODA can be used as mitigation finance, the amount of ODA allocated to climate mitigation is increasing much faster than that allocated to poverty aid (Figure 1.2). Figure 1.3 shows that the share of mitigation finance in total ODA has gradually increased since 1998, and from 2008 it has increased significantly.

Figure 1.2: Trends in official mitigation finance



Note: Figure by the author using data from OECD (2012a). Official mitigation finance (principal and significant) includes all aid projects which have mitigation as a principal or significant objective. Official mitigation finance (principal only) only includes projects with mitigation as a principal objective. See Section 1.3 for more details. Poverty aid is total ODA minus official mitigation finance.

Figure 1.3: Trend of official mitigation finance in total ODA



Following discussions about climate finance at COP13 the landscape of climate finance has been changing dramatically. A comprehensive and detailed report explains the landscape of climate finance (Buchner *et al.*, 2011). Although there are more detailed features of climate finance, i.e. the basic framework of ODA allocated to climate mitigation (hereafter, official mitigation finance) is similar to that of ODA more generally.

Official mitigation finance is divided into the donor and the recipient domains. It is taken from ODA and mainly originates from taxpayers in the donor countries. As voters, taxpayers have given their government the right to take decisions on their behalf about the distribution and allocation of government revenue from tax and other sources such as net export and import, FDI inflow, levies, etc. Part of these revenues is used as foreign aid and recorded as government spending in the form of foreign financial transfers. Based on the priority sectors, such as energy, forestry, agriculture, transportation, and industry, the funding is allocated and delivered through various intermediaries, instruments, and channels depending on the government's objectives, interests and areas of focus. Major donors can allocate mitigation finance through intermediaries such as development banks and their lines of ministries.

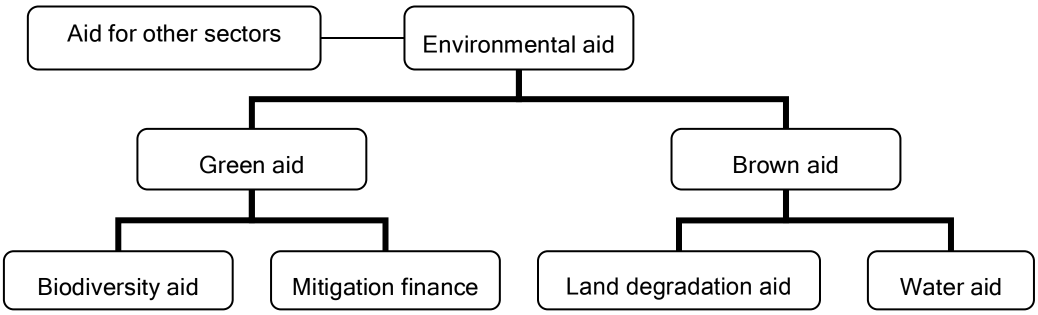
Donor intermediaries, then, channel the funds to developing countries using instruments such as grants, concessional loans, market rate loans, equity, and risk management. Specific intermediaries also directly administer or facilitate climate projects in developing countries, such as the *United Nations Development Programme (*UNDP) with its Reducing Emissions from Deforestation and Forest Degradation (UN-REDD) programme. Mitigation finance may also be given directly to recipient governments in different forms of aid modalities (Gibson *et al.*, 2005, p. 120) such as program aid given as sectorial budget support (SBS) or debt relief. SBS allows the recipients to allocate foreign aid to any project, including environmental projects, if the latter are recognised as national development priorities (Bandstein, 2007).

More recently a number of vertical funds have focused on specific issues and provided funding as project aid, such as short- to medium-term projects under specific government ministries, and sub-contract agreements with local and international Non-Governmental Organisations (NGOs) or local companies. Complementing the GEF's work, in 2009 the Green Climate Fund (GCF) was established specifically to channel climate finance toward mitigation and adaptation activities. These vertical funds allocate and distribute climate finance, including mitigation finance given by donor governments, private companies, NGOs, and individuals to recipient governments, or directly to projects managed by the government, the private sector or NGOs in developing countries. Private companies receive climate finance as an incentive for their carbon emission mitigations (IFC, 2011). NGOs such as the Nature Conservancy and Greenpeace also receive funding for mitigation projects (Virgilio *et al*., 2009). These channels transfer climate funding to NGOs that run regional and local projects. Some of these NGOs also facilitate direct donations from citizens for climate projects in developing countries.

In an empirical study of broader environmental finance, Hicks, *et al*. (2008a) separate environmental aid into two categories: brown aid, which produces local benefits, and green aid, which provides global benefits (Figure 1.4). The study by Hicks *et al*. (2008) does not specifically refer to climate finance. Implicitly, mitigation finance, foreign assistance with global environmental benefits, would be classified under green aid, alongside biodiversity aid. Therefore, according to Hicks *et al*. (2008), mitigation finance is only one of the two sub-categories under the green aid.

According to the definitions of green and brown aid given above, adaptation finance, which aims to help local communities that are vulnerable to negative effects of climate change, can be categorised as brown aid.

Figure 1.4: Mitigation finance in the hierarchical context of environmental aid



Note: The classification is drawn from Hicks *et al*. (2008)

Global Environmental Facility (GEF) also has a mandate from the UNFCCC to facilitate funding mechanisms for climate-related activities. GEF classifies its environmental aid into seven focal areas: biodiversity, climate change, international waters, ozone-depleting substances, land degradation, persistent organic pollutants and multifocal areas. Climate change is recognised separately from these. Among these classifications, the Rio Marker classification is the formal structure recognised by the UNFCCC.

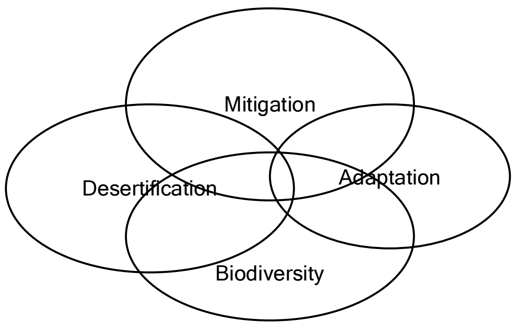
This thesis focuses on analysing official mitigation finance, which is a small but increasing element of overall ODA as shown in Figure 1.3. While other categories of climate finance such as private climate finance and finance for adaptation activities (hereafter 'adaptation finance') are also relevant here, the scope of this thesis is limited to official mitigation finance for reasons of time and data availability.

1.3. Data on official mitigation finance: the Rio Marker database

The data for official mitigation finance used in the thesis are obtained from the OECD database, which codes reported projects funded by the ODA according to Rio Marker system. Rio Marker database of the OECD Creditor Reporting System (CRS) is a data platform for DAC donors to report details of development projects in developing countries funded by foreign aid. The CRS is managed separately from the DAC's annual aggregate database and provides more specific information on individual projects, with details of sectors, countries, project descriptions, etc, while the DAC's annual aggregate database places more emphasis on the volume, origin and type of aid and other resource flows.

The Rio Marker database is the product and follow-up action of the 1992 Rio Earth Summit at which the three Rio Conventions were established. The Rio Marker system is a feature specifically designed and added to track the level of each project's contribution to the objectives of the Rio conventions that are categorised into four groups, namely climate mitigation, climate adaptation (added in 2010), biodiversity, and desertification (see Figure 1.5).

Figure 1.5: Climate finance classification under the Rio Markers



The coding or marking system is used to track the contribution of each project. This system was introduced in 1995 but most donors gradually began to report and mark their projects, some more consistently than others, from 1998 onwards. The Rio Marker 2010 coding shows that it is possible for a project to have multiple objectives, e.g. a reforestation project can have the objectives of protecting biodiversity as well as mitigating emissions.

Under the Rio Marker coding system an activity can independently and simultaneously contribute to all the objectives of the Rio conventions. For example, Table 1.1 shows a hypothetical example of three projects that are all marked as contributing to climate change mitigation. Projects A and C have mitigation as the 'principal' (primary) objective. Project A also has biodiversity and desertification as 'significant' (secondary) objectives, but Project C does not have these other objectives. Project B, by contrast, has all three conventions as 'significant' objectives, but none is the 'principal' objective. Double counting occurs if one compiles the total financial inflows to more than one convention, such as adding up the amounts of funding pledged for climate change and biodiversity, so then projects A, B and C are counted twice. The total is supposedly US$600 for commitment and US$350 for disbursement, but instead, one can double count and result in total of US$1,100 for commitment and US$650 for disbursement. The extra US$500 and US$300 for commitments and disbursements respectively are added because the biodiversity elements of Project A and B are counted twice.

Table 1.1: The hypothetical development projects with Rio markers

	Inflow in US$		Rio Marker		
	Commitment	Disbursement	Mitigation	Biodiversity	Desertification
Project A	300	200	2	1	1
Project B	200	100	1	1	1
Project C	100	50	2	0	0

Not all projects in the CRS database include Rio markers; some are unmarked. The OECD did not explicitly address this problem until 2013, when it made reporting more explicit by specifying the amount allocated to unmarked projects in the data interface. According to data taken from OECD CRS project level data set (OECD, 2012a), the total number of unmarked ODA projects has fallen from 32.3% in 2002 to less than 1% after 2007 (see Table 1.2). Similarly the absolute amount of ODA allocated to projects that are unmarked or whose contribution to mitigating emissions is undetermined falls drastically after 2006. The amount of ODA commitment to these unmarked projects in 2007 is only approximately 10% of that in 2006. The strategy used to overcome the problem of unmarked projects is discussed further below.

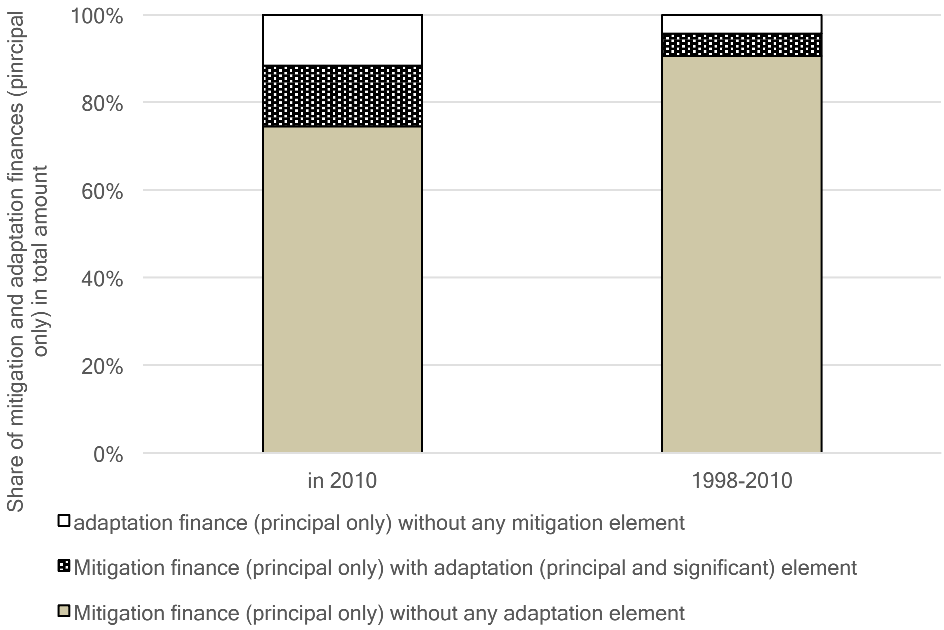
Table 1.2: Numbers of unmarked projects in CRS project-level database

Year	Number of ODA projects recorded in CRS	Number of ODA projects recorded with mitigation objective unmarked	% of number of ODA projects with mitigation objective unmarked	The amount of ODA commitment in CRS in million US$	The amount of ODA committed to recorded projects whose mitigation objective is unmarked (in million US$)
1998	3920	361	9.2	3296.6	352.9
1999	4719	651	13.8	3407.3	543.7
2000	5532	1072	19.4	2421.6	391.5
2001	5338	1228	23.0	3800.0	443.8
2002	5150	1662	32.3	4706.0	673.8
2003	6223	1078	17.3	7301.4	387.8
2004	12493	1072	8.6	11816.8	402.0
2005	31353	1095	3.5	39821.5	940.9
2006	62106	1215	2.0	43046.3	716.2
2007	65535	94	0.1	43118.1	87.4
2008	65535	121	0.2	47195.6	192.9
2009	65535	158	0.2	49600.9	67.9
2010	65535	245	0.4	56297.4	77.9

Data source: OECD (2012a)

From 2010 onwards the OECD Rio Marker climate change data specify whether the finance was provided for mitigation or adaptation. In terms of overall amounts, mitigation finance is more dominant than adaptation finance, although since 2010 the latter has gradually been increasing. In 2010 the share of mitigation finance in ODA was four times larger than the share of adaptation finance (Figure 1.6). Before 2010, projects recorded as addressing climate change had ‘climate change mitigation’ as a principal or significant objective. The projects may also have contributed to climate change adaptation, but the OECD does not have this information.

Figure 1.6: The composition of official mitigation and adaptation finance (million US$ constant 2010 prices)



Note: Figure by the author using OECD (2012a) data. This includes all projects with adaptation/mitigation as a principal objective, and all projects that have adaptation/mitigation as a principal or significant objective.

To differentiate mitigation from adaptation finance, the specific criteria for marking ODA funded projects as contributing to climate change mitigation are introduced as following (OECD, 2011b):

> *The activity contributes to (1) the mitigation of climate change by limiting anthropogenic emissions of GHGs, including gases regulated by the Montreal Protocol; or (2) the protection and/or enhancement of GHG sinks and reservoirs; or (3) the integration of climate change concerns with the recipient countries' development objectives through institution building, capacity development, strengthening the regulatory and policy framework, or research; or (4) developing countries' efforts to meet their obligations under the Convention.* (*ibid*)

The activities funded by mitigation finance involve many sectors such as water, transport, energy, agriculture, and forestry and industry. Typical activities in these sectors include:

- *GHG emission reductions or stabilisation in the energy, transport, industry and agricultural sectors through application of new and renewable forms of energy, measures to improve the energy efficiency of existing generators, machines and equipment, or demand side management.*
- *Methane emission reductions through waste management or sewage treatment. Development, transfer and promotion of technologies and know-how and building of capacities that control, reduce or prevent anthropogenic emissions of GHGs, in particular in waste management, transport, energy, agriculture and industry.*
- *Protection and enhancement of sinks and reservoirs of GHGs through sustainable forest management, afforestation and reforestation, rehabilitation of areas affected by drought and desertification.* (*ibid*)

Non-sector-based mitigation finance activities comprise environmental policy and administrative management, biosphere protection, biodiversity and environmental education and training, and environmental research. Typical activities from group that are considered from none of the sector above such as (*ibid*):

- *Protection and enhancement of sinks and reservoirs through sustainable management and conservation of oceans and other marine and coastal ecosystems, wetlands, wilderness areas and other ecosystems.*
- *Preparation of national inventories of greenhouse gases (emissions by sources and removals by sinks); climate change related policy and economic analysis and instruments, including national plans to mitigate climate change; development of climate-change-related legislation; climate technology needs surveys and assessments; institutional capacity building.*
- *Education, training and public awareness related to climate change, climate-change-mitigation related research and monitoring.*
- *Oceanographic and atmospheric research and monitoring.*

The 2010 Rio Marker defines adaptation finance as ODA allocated to:

> *…activities that aim 'to reduce the vulnerability of human or natural systems to the impacts of climate change and climate-related risks, by maintaining or increasing adaptive capacity and resilience.* (*ibid*)

Mitigation finance before 2010 may have partly funded adaptation activities, but this is likely to be limited to mitigation activities indirectly related to GHG emission reduction or stabilisation, namely in projects marked 'significant' and not 'principal'. For example, according to the criteria for mitigation finance, above, and the examples given in the Rio Marker Handbook (*ibid*), mitigation finance covers activities such as education, training and oceanographic and atmospheric research and monitoring. Although these activities may not be designed specifically for the purpose of adaptation, they may contribute to it or be carried out in combination with adaptation activities. For adaptation finance, a range of activities are categorised as having adaptation as the "principal" objective. Examples include enhancing information system to disseminate weather related information, capacity building of national ministries, improving coordination and planning of national adaptation activities, tracking and monitoring the stocks of variety of fish species, coral reefs and mangrove conservation, and protecting the rights of indigenous people related to the utilisation of forest.

To date, the OECD Rio Marker database has been widely used by donors and recipients to monitor activities related to the Rio Conventions. However, there are two main concerns about the accuracy of Rio Markers and its effect on the aggregate figure of climate finance provision. First, Michaelowa and Michaelowa (2011) argue that climate finance data can be over reported and overestimate the aggregate provision, and that this is politically-driven and intentional rather than coincidental. Their study defines projects contributed to climate change if in the project descriptions, it contains the keywords namely cogeneration, composting, efficient stoves, efficiency improvements (power plant rehabilitation), gas flaring reduction, industrial gas reduction, landfill gas and methane recovery, renewable energy (including biomass power, geothermal, hydro, solar photovoltaics/thermal, and wind), solid waste management in large cities, transport (including rail, public transport and river/inland shipping activities), waste to energy, and waste water. Forestry-related keywords such as forest protection, afforestation and reforestation were also included (see Appendix A in Michealowa and Michaelowa (2011)). Projects with project descriptions that do not include these words are considered ‘misaligned’ or ‘irrelevant’ but are coded as contributing to the Rio Marker objectives, while those without project descriptions are classified as ‘unclear’. They demonstrate that these coding errors can be influenced by, *inter alia*, donor governments’ ideological motives and national voters’ environmental preferences, which are measured by the percentage of the population in every donor country considering the severity of the greenhouse effect and alternatively by the share of green party’s seats in the national parliament. While this is an improvement in the right direction, their approach is not flawless - during the data collection for this thesis many projects were found to be insufficiently or poorly described, often in languages other than English such as Spanish and French.

So far the OECD has not set a standard format for project descriptions. This would improve the uniformity of reporting across projects and donors and improve the overall Rio Marker dataset. There is also an absence of formal verification by, for instance, independent data auditors, who could evaluate the coding errors and explain how they occurred. It is not the aim of this thesis to conduct such an investigation and therefore the author assumes that the coding errors are coincidental and could occur due to several reasons such as: (1) lack of systematic and compulsory education about the implementation of the system; (2) lack of comprehension and awareness of new developments in climate science (Whitmarsh *et al.*, 2011) and (3) media-induced misconceptions of climate change, its impacts and how to respond to it (McCaffrey & Buhr, 2008).

The second concern is that climate finance tends to be underreported. This argument part of the findings in this thesis and this is presented and analysed in the next chapter. As previously discussed, a small number of projects are not marked. These unmarked projects may contribute to the mitigation objective, but we cannot be sure. To avoid a false inference based on insufficient grounds, in this thesis these projects are classified differently from zero allocation and excluded from the data in use. In addition some ODA-funded climate change projects may be unreported. Donors might not report such a project for several reasons: its insignificant size; lack of capacity to record and report the data; and national policy that does not promote accountability and transparency regarding ODA. However, donors are expected to seriously consider the above since coding every development project using CRS became obligatory in 2007 (Benn, 2010).

As a result of the existence of these two grey areas researchers and non-governmental institutions have to expend considerable effort to tracking climate finance projects (Buchner *et al*., 2011). Many institutions offer alternative datasets, such as Aid Data 2.0 and Climate Funds Update. However, many of these alternatives are still in their infancy; the former has been found to have many instances of double counting and the latter does not indicate whether the volume of the transaction is in nominal or real value. It is necessary to have further training on reporting climate finance projects using CRS for donors and recipients (Tirpak *et al*., 2010).

Therefore, in evaluating the allocation of mitigation finance this thesis mainly relies on the OECD Rio Marker system as the only formal source of data available on official mitigation finance, even though it is very difficult to remove invalid and irrelevant projects, which are considered coding errors (Michealowa & Michaelowa, 2011). This research does not eliminate projects that they consider as irrelevant. One of the major reasons is the incompleteness of project descriptions. There is no systematic approach that can be used to filter irrelevant projects and dismiss them if they contain insufficient descriptions.

In response to this potential for under-reporting mitigation finance data, in this thesis uncoded data are treated cautiously and are not simply assumed to refer to a zero allocation of mitigation finance. To unveil the unexplained reasons for donors' under-reporting behaviours, this thesis tests several factors representing donor characteristics that influence their reporting performance.

1.3.1. Data collection methods

The OECD updated the Rio Marker system several times during the period in which this research project was conducted. These changes created considerable challenges in terms of ensuring consistency in mitigation finance data across the three empirical studies (i.e. the analysis found in Chapters 2, 3 and 4). In response to this evolving dataset slightly different approaches were taken to collecting the data used in Chapter 2 and those used in the following chapters, as summarised in Table 1.3.

Table 1.3: Summary of data collection method used in three stand-alone empirical studies

Ch.	Date extracted	Source	Mark of climate change	Mark of other objectives	Definition of mitigation finance based on data
2	10 Nov 2010	OECD CRS interface panel data	2,1	0	Climate mitigation outflow (commitment and disbursement) from each of the 22 DAC donor countries per year to all countries and regions
3	7 Apr 2012	Project level data	2	2, 1, 0	Climate mitigation inflow (commitment and disbursement) per developing country (180) per year from *all* DAC bilateral (22) and multilateral (1) donors
4	7 Apr 2012	Project level data	2	2, 1, 0	Climate mitigation inflow (commitment and disbursement) per developing country (180) per year from DAC *individual* bilateral (6) and multilateral (2) donors

The data for Chapter 2 were collected in early 2010, before major improvements were made to the Rio Markers. The 1998-2009 data were obtained through the OECD CRS interface, which classifies projects funded by ODA into seven categories depending on the purpose of the ODA provided: (1) only climate change, (2) only biodiversity, (3) desertification, (4) biodiversity and climate change, (5) desertification and climate change, (6) biodiversity, desertification, and climate change and (7) others. In Chapter 2 the term ‘official mitigation finance’ refers to the first category, which is ODA provided for climate-change mitigation only but not biodiversity or desertification. Thus, in Chapter 2 ‘official mitigation finance’ corresponds to the annual amount of funds transferred from the individual 22 DAC donor countries (Luxembourg is excluded as it does not contribute) solely for the purpose of climate change mitigation activities to all developing countries, or regions in the case of financial allocations not designated for specific developing countries. This includes projects that are marked ‘2’ (principal objective) as well as those marked ‘1’ (significant objective) for climate change mitigation, in each case with ‘0’ for biodiversity and desertification.

A different approach would be to add up joint categories that have climate change and other Rio Marker elements (in this thesis, this is labelled as 'mixed mitigation finance'). While the data availability is slightly higher for mixed mitigation finance than for 'mitigation finance' (215 compared to 199 observations), the analysis in Chapter 2 primarily focuses on the determinants of the 'mitigation finance' variable that correspond to exclusive commitment to climate change mitigation which covers elements of adaptation to some extent. This approach will reduce the chance of double counting of mitigation finance that was explained earlier in this section. However, 'mixed mitigation finance' will still be taken into account to be compared with 'mitigation finance'.

When it came to examining the allocation of mitigation finance across developing countries in 2012, the OECD CRS interface was under construction and the Rio Marker option was de-activated. Instead, the OECD data administrator encouraged the use of OECD CRS project-level data to access the Rio Markers. The project-level data allow more flexibility in the use of the coding system: in particular, the ability to distinguish between projects marked '2' and those marked '1'.

In response to these changes, mitigation finance in Chapters 3 and 4 includes all projects whose mitigation objective is marked as 2 (principal), regardless of their contributions to other objectives (2, 1 or 0). This approach minimises the inclusion of projects unrelated to climate change objectives. Thus in these two chapters the mitigation finance data only include projects with climate change as the principal objective (projects with mitigation objective marked '2'). These projects are still included if they also contribute to other Rio conventions, i.e. biodiversity and desertification, as well as adaptation for data reported in 2010. This approach has two main advantages: first, it does not exclude mitigation finance with shared objectives, and second, it protects against double counting.

The differences between how the data were extracted in Chapter 2 and how this was done in the following chapters may give an impression of inconsistency. In conducting three stand-alone studies, this research followed the rapid changes in the global mitigation climate finance system in response to the urgent issue of climate change. The way the system accommodates climate mitigation affects how the data are collected and used. Therefore the differences should not be seen as a lack of consistency but as development and progress in how this research evolved, following the evolution of climate mitigation data. This evolution process shows the considerable implications of the changes of the OECD's reporting system for the ways in which climate finance data can be utilised and defined.

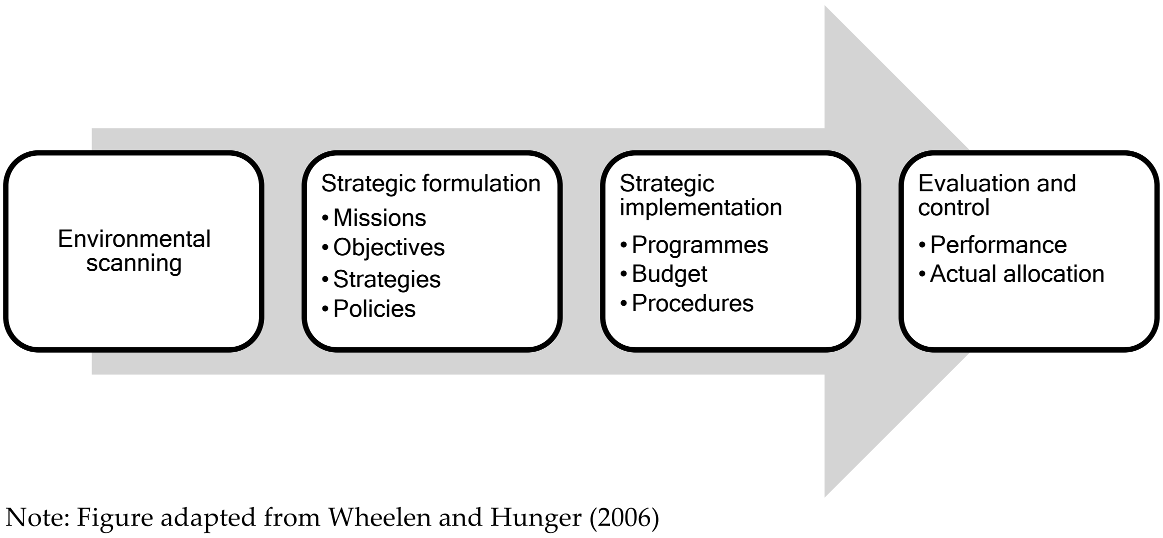
When Chapter 2 adapts the data collection approach applied in Chapter 3 the statistical significance of certain variables may be affected while the sign of the coefficient remains consistent. It is likely that variables such as emission variables become statistically significant. The remaining specificities of the data used in Chapters 2, 3 and 4 are discussed separately in the corresponding chapters.

1.4. Academic and policy relevance

The IPCC emphasises the need to identify the determinants used by donors in distributing financial resources across developing countries (2001, pp. 107-108). This thesis can be seen in the broader global strategic management process as an evaluation and control process evaluating actual allocation (Figure 1.7). The results of the evaluation inform how donors' strategic implementation reflects their strategic formulation, as stated in the UNFCC Conventions.

Lack of transparency acts as a barrier to understanding whether actual implementation has attained its intended objective, indicating success. Thus the results and findings of this thesis are highly relevant to a better understanding of how donors allocate mitigation finance to achieve the objectives of their mitigation finance and to reduce global GHG emissions. It is widely accepted that mitigation finance is most effective when it is allocated at the appropriate time to countries whose GHG emissions can be mitigated on a large scale. Understanding the determinants of mitigation finance used by donors will be useful for future reference for both donor and recipient countries to improve the efficiency of limited funds and allow the allocation of mitigation finance to countries that can produce the highest impact on global GHG emissions. Information on the determinants of mitigation finance allows policy-makers to evaluate the existing global allocation of mitigation finance and to formulate policies that can lead to improved effectiveness and allocation of mitigation finance in future.

Figure 1.7: Strategic management process



Note: Figure adapted from Wheelen and Hunger (2006)

This thesis also makes a significant contribution to the aid and climate finance literature. A number of studies look at aid allocation more broadly, such as those of Alesina and Dollar (2000) and Hoeffler and Outram (2011), but the categories of ODA based on specific objectives are still under research. This thesis examines the allocation of ODA for climate change mitigation and provides insights into whether such aid is allocated according to specific objectives related to climate change mitigation as opposed to the broader objective of alleviating poverty and promoting economic development.

1.5. The research questions and the empirical assessment framework

This thesis aims to contribute to understanding of the factors that affect aid donors' provision and allocation of official mitigation finance. It contains three main empirical chapters and one conceptual chapter.

Chapter 2 assesses the provision of mitigation finance by 22 bilateral donors[3] in the OECD Development Assistance Committee (DAC) and asks two sub-questions: (1) What characteristics of donors influence the amount of mitigation finance that they provide? (2) What characteristics of donors influence their reporting of the mitigation finance?

Chapter 3 assesses how mitigation finance from 23 DAC donors[4] is allocated across developing countries. This chapter asks four sub-questions: (1) what characteristics of developing countries determine the inflow of mitigation finance? (2) Are there any differences between the determinants of mitigation finance and overall ODA? (3) Do developing countries' environmental commitments, shown through their

[3] Excluding Luxembourg
[4] Excluding Luxembourg, but including the EU

pledges on international climate change related treaties, affect the amount of mitigation finance they receive? (4) Have the determinants of mitigation finance varied over the different periods of the Kyoto Protocol?

Chapter 4 compares eight individual bilateral and multilateral donors' allocation of mitigation finance. This last empirical chapter addresses two main questions: (1) Do the determinants of mitigation finance grants differ from those of mitigation finance loans? (2) Do the determinants of mitigation finance commitments differ from the determinants of mitigation finance disbursement? Chapter 4 also looks at the existing allocation of financial resources by multilateral institutions and vertical funds, and its implications.

Chapter 5 addresses two questions using the institutional and development framework as a guidance. The first question asks what qualities or aspects of mitigation finance act as incentives for mitigating GHG emissions in developing countries. It particularly considers whether mitigation finance offers a perverse incentive. The second question asks about the foreseeable arrangement of mitigation finance as a new international financial category, particularly exploring whether mitigation finance is only temporarily reliant on ODA as its source of funding or will become a permanent part of ODA.

Chapter 6 draws conclusions and shows how the questions asked in each chapter contribute to answering the overarching question: What are the determinants of the provision and allocation of foreign aid for the mitigation of climate change.

2. DONOR CHARACTERISTICS AND THE SUPPLY OF CLIMATE MITIGATION FINANCE*

Abstract

This chapter examines the links between donor country characteristics and official mitigation finance. Fixed-effect and random-effect models and robustness checks are used to evaluate the impact of donor characteristics on the proportion and volume of mitigation finance commitment and disbursement in total ODA provision, and to test whether the results are consistent. The findings show that many donor countries under-reported their provision of mitigation finance in the early years of the OECD's Creditor Rio Marker System (CRS) records affecting the accuracy of the estimations. Robustness checks across two models show that donor countries' institutional and a share of clean energy in energy mix significantly influences how much of their ODA they allocated to tackling climate change mitigation; and, unexpectedly, wealthier donors with greater economic capacity appear to be slower to disburse allocated funds. The proportion of environmental expenditure in the governmental budget negatively affects the amount of mitigation finance provided, signifying that there is competition for financial resources between domestic environmental expenditure and overseas mitigation finance.

Key words: Climate mitigation finance, development aid, ODA, donors

2.1. Introduction

In recent years many scholars have attempted to define the motives behind the supply of ODA. It is commonly argued that donors' motives extend beyond the altruistic objective of improving the economy and well-being of people in developing countries (Alesina & Dollar, 2000; Berthelemy, 2006; Hoeffler & Outram, 2011; Maizels & Nissanke, 1984; McKinlay & Little, 1977; Trumbull & Wall, 1994). Lewis (2003) argues that this also applies to the case of environmental aid. The economic and political interests of donors are often much stronger determinants of environmental aid than the environmental needs of the recipient countries. In the past decade there has also been a significant increase in bilateral ODA aimed at

* This chapter is an updated version of Halimanjaya and Papyrakis (2012) that has undergone major revisions.

funding activities that tackle climate change (Ballesteros & Moncel, 2010; Bierbaum & Fay, 2010; Brown *et al.*, 2010; ICTSD, 2010; Michaelowa & Michaelowa, 2007).

With a more specific focus than environmental ODA, official mitigation finance largely aims at minimising GHG emissions. To date there is no literature empirically investigating the linkages between donors' economic, political and institutional characteristics such as their GHG emission levels and provision of official mitigation finance. This chapter contributes to the literature by empirically examining the role of several characteristics of the 22 DAC donors in their provision of mitigation finance over the last 12 years (1998-2009). The DAC donors included in this chapter are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Republic of Korea, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden; Switzerland, the United Kingdom and the United States. Luxembourg is not included due to the limited number of observations available.

To develop an empirical framework for the case of mitigation finance, this chapter draws on the wider literature investigating the links between donor characteristics and general development or environmental aid, such as the study by Chong and Gradstein (2008) which finds that countries whose citizens are satisfied with their governments' performance and with higher levels of income per capita tend to provide more general foreign aid. Hicks *et al.* (2008) investigate environmental aid provision and donor characteristics using data from the Project-Level Aid Database (PLAID, now renamed Aid Data 2.0). They find that wealthy bilateral donor countries are likely to allocate their aid to green projects with global benefits, but when they control for fixed effects they find no evidence that bilateral donors' level of wealth determines their allocation of aid to environmental projects. Their results are not robust to alternative empirical models; they find no evidence that institutional/political characteristics, such as the strength of environmental lobby groups, affect the allocation of aid for environmental purposes.

This chapter specifically focuses on identifying the country-specific determinants of mitigation finance drawn from the literature on environmental and overall aid and reflected in the 1992 UNFCCC principles and seeks to identify what donor characteristics determine their provision of mitigation finance. The findings are expected to directly contribute to international policymaking. These findings inform international negotiators in the UNFCCC COP about which donor characteristics determine the actual provision of mitigation finance. The identified determinants can be a useful reflection of the extent to which developed countries are responding to the normative principles of tackling climate change stated in the 1992 UNFCCC. The findings also contribute to the broader study of environmental aid and ODA. The chapter highlights the determinants of categories and subcategories of official aid whose consistency of their signs and statistical significance can be compared across aid at different levels.

The analysis in this chapter follows the methodology employed by Hicks *et al.* (2008b) who apply panel regressions and in particular the fixed-effect model to investigate the political, economic and institutional characteristics of donors in shaping the provision of environmental aid. Their study is the closest to the subject of this research, although its focus on environmental aid is broader. A set of determinants similar to those used in Hicks *et al*.'s (2008) study is used here with the inclusion of some additional regressors (e.g. the proportion of donor government budget spent on national environmental projects from its total budget, hereafter 'donor environmental budget') and the level of carbon dioxide (CO_2) emissions per capita, as proxies for the importance given to environmental issues at the government level and the level of donor carbon intensity, respectively. It is expected that the donor environmental budget, the level of CO_2 emissions and other types of

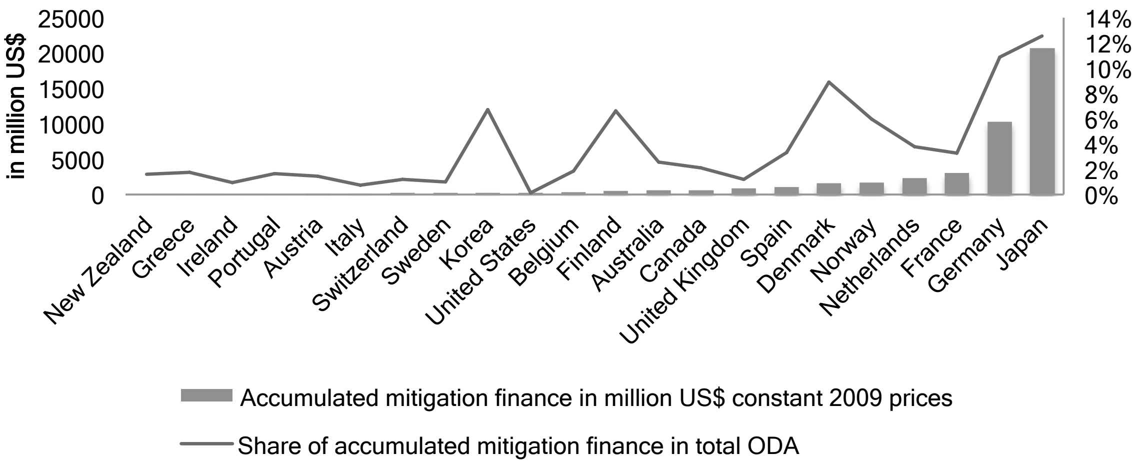
GHG emissions, and the level of income per capita, all positively affect the amount of ODA allocated to climate-change mitigation. Furthermore, this chapter contributes to the literature by considering and highlighting the possibility of a selection bias arising from donors' under-reporting of their mitigation finance data. This study describes the patterns behind such under-reporting and identifies the donor characteristics that determine under-reporting behaviour.

The next section looks at current trends in official mitigation finance. Section 2.3 describes the extent of underreporting of mitigation finance provision and analyses the distributional pattern of donors' reporting performance. Section 2.4 discusses the hypotheses tested in this chapter; section 2.5 explains the econometric methods used to test the hypotheses; section 2.6 empirically studies the connection between donor characteristics and the provision of the absolute amount of mitigation finance and the proportion of mitigation finance in total ODA, using different estimation strategies. This section also compares the consistencies of signs of variables that affect the proportion of mitigation finance in total aid commitment and disbursement to reflect donors' rhetoric and action. Section 2.7 concludes.

2.2. Trends in official mitigation finance

Donor countries vary with respect to their provision of ODA for climate-mitigation related activities. Although Japan only started to report data on its commitment to providing mitigation finance in 2002, it has made the largest contribution to mitigation finance both in absolute values and as a proportion of total ODA (see Figure 2.1). It allocated 12.5% of its total ODA from 2002 to 2009 to mitigation finance with a cumulative value close to US$20 billion. Japan is followed by Germany, whose mitigation finance amounts to 10.9% of total ODA. Its contribution of mitigation finance in total ODA has increased significantly in the past decade (see Figure 2.1). This increasing trend reveals a growing interest in allocating ODA to mitigation related activities.

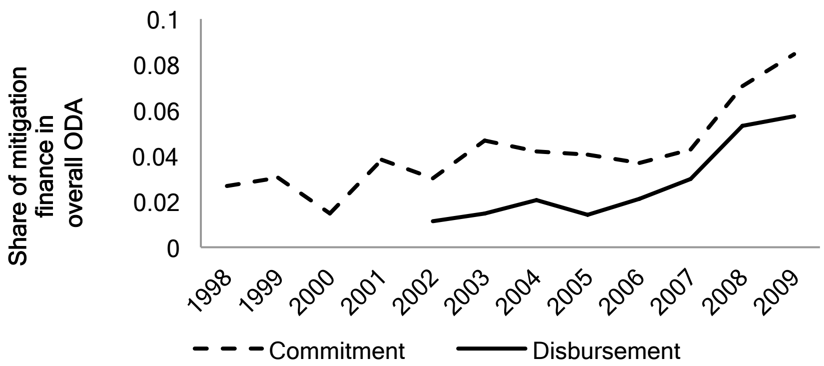
Figure 2.1: Donors' commitment to mitigation finance (1998-2009)



All figures in this chapter are by the author using data from (OECD, 2009a)

Two additional observations are worth noting. First, mitigation finance disbursement has been consistently lower than commitment, although the former has increased over time. Donors take several years to meet the amount of mitigation finance they have committed to provide. Interestingly, the disbursement-commitment gap narrowed between 2007 and 2008 and as a whole mitigation finance disbursement grew faster than mitigation finance commitment (Figure 2.2).

Figure 2.2: Trend in mitigation finance commitment and disbursement



Between 1998 and 2009, commitment of mitigation finance rose from US$1.2 to US$9.2 billion (i.e. by 7.6 times), while between 2002 and 2009 there was a nine-fold increase from US$600 million to US$5.4 billion in the amount of mitigation finance *disbursed* (see Table 2.1 below).

Table 2.1: Donor commitment and disbursement of mitigation finance (in million US$ constant 2009 prices)

Year	Mixed mitigation finance (1)+(2)+(3)+(4)		Only mitigation finance (1)		Biodiversity and mitigation finance (2)		Desertification and mitigation finance (3)		Biodiversity, desertification, and mitigation finance (4)	
	C	D	C	D	C	D	C	D	C	D
1998	1249.7		499.8		213.1		286.3		250.5	
1999	1682.4		1055.7		214.6		88.4		323.7	
2000	867.9		346.9		225.0		28.0		268.0	
2001	2200.9		1490.4		208.2		52.5		449.7	
2002	2020.3	668.5	1121.8	287.2	474.1	105.5	24.8	44.7	399.6	231.1
2003	3955.9	1033.0	2941.5	646.1	210.4	150.8	38.0	48.6	766.1	187.4
2004	3480.6	1474.1	2731.8	968.8	155.1	124.0	47.6	67.6	546.0	313.7
2005	4438.6	1440.9	3324.7	1096.4	186.0	105.6	58.6	19.0	869.3	219.9
2006	4119.6	2022.7	2794.5	1423.4	264.4	116.2	112.3	24.7	948.4	458.4
2007	4061.9	2619.8	2703.7	1780.2	313.0	200.9	48.6	35.0	996.6	603.6
2008	7919.8	5138.3	6308.3	3890.8	258.8	266.6	215.4	71.7	1137.2	909.2
2009	9205.6	5429.1	7369.0	4255.1	1191.3	530.0	128.6	74.3	516.6	569.8

Note: C = Commitment; D = Disbursement

2.3. Under-reporting of mitigation finance data

The existence of underreporting of mitigation finance during the early years of the OECD's CRS could lead to underestimation of the overall contribution of mitigation finance. The implications are still under discussion and the reason some donors tend to report more than others remain unclear.

This section clarifies the pattern of donor reporting behaviour and discusses some of possible causes for the implications of this underreporting during the voluntarily period of the OECD CRS (1998-2006). It does not evaluate how well the donors' reporting matches the OECD's criteria; Michaelowa and Michaelowa (2011) point out the mismatch between some reported activities and their self-defined criteria for climate-related aid. Instead this section and the entire thesis assume that all reported activities to the OECD align with OECD criteria, although there may be misalignments, the reasons for which are discussed later.

In the early years of implementing the Rio Marker CRS, some donors did not report their contributions to mitigating climate change, although prior to the Rio Markers, DAC donors funded projects which can be categorised under climate mitigation. Potter (1994) shows that Japan funded environmental-aid projects that fitted the mitigation category of the Rio Markers even before 1998. However, the OECD data shows that Japan has only engaged in funding mitigation activities since 2002, when it started to record its disbursements under the climate mitigation objective. Similarly, Lewis (2003) points that USAID provided aid for pollution prevention in India and Chile in 1996-1998 while the OECD CRS suggest that it only started allocating ODA to climate mitigation in 2003 because that was it started to report it to the OECD.

In this chapter, when donors do report their contribution to an activity in a particular year, this piece of data is shown as an 'empty cell' and is treated differently from zero. When donors report not providing any money to fund mitigation activities, this is recorded as '0' (zero). This assumption is made based on the fact that before the Rio Markers were introduced in 1992 and the data were effectively recorded from 1998 under voluntarily mechanism. Figure 2.3 shows an increase in the reporting of mitigation finance data over time, although some countries have consistently underreported it. For example, Japan has only nine years of available data on projects purely addressing emission mitigation and projects whose objective is mitigation combined with combating desertification and protecting biodiversity (Figure 2.4). Norway is the only donor that constantly reports its ODA projects, according to the Rio Marker CRS, and hence has a full 12 years of data on all the Rio Markers.

Figure 2.3: Number of donors reporting mitigation finance commitment and disbursement

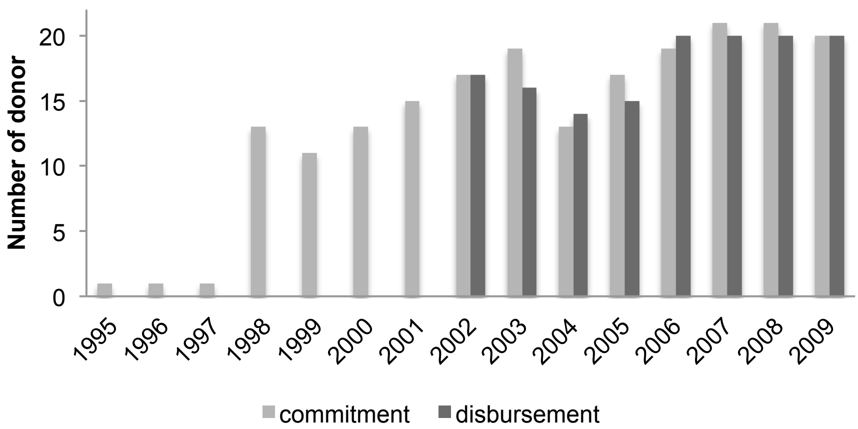
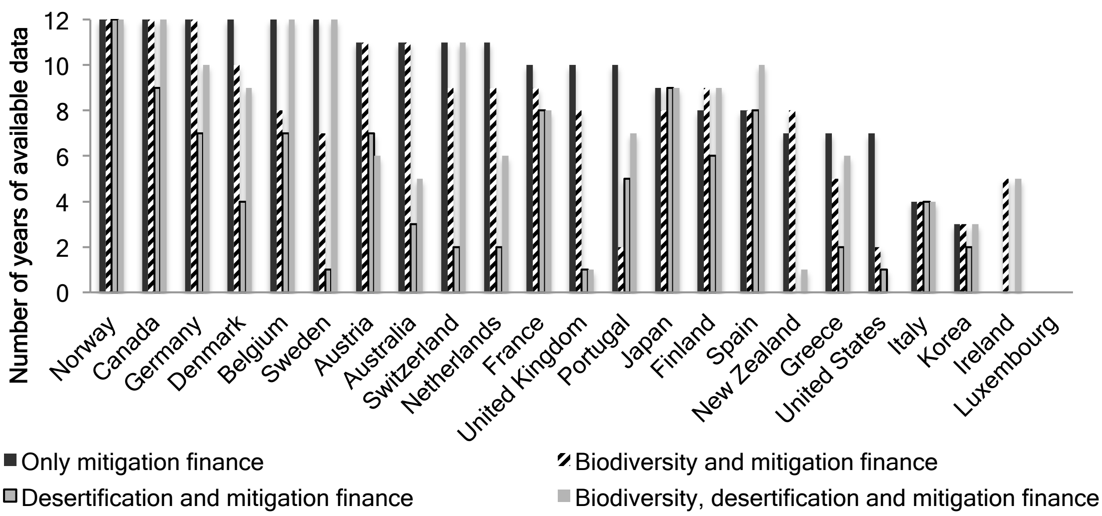
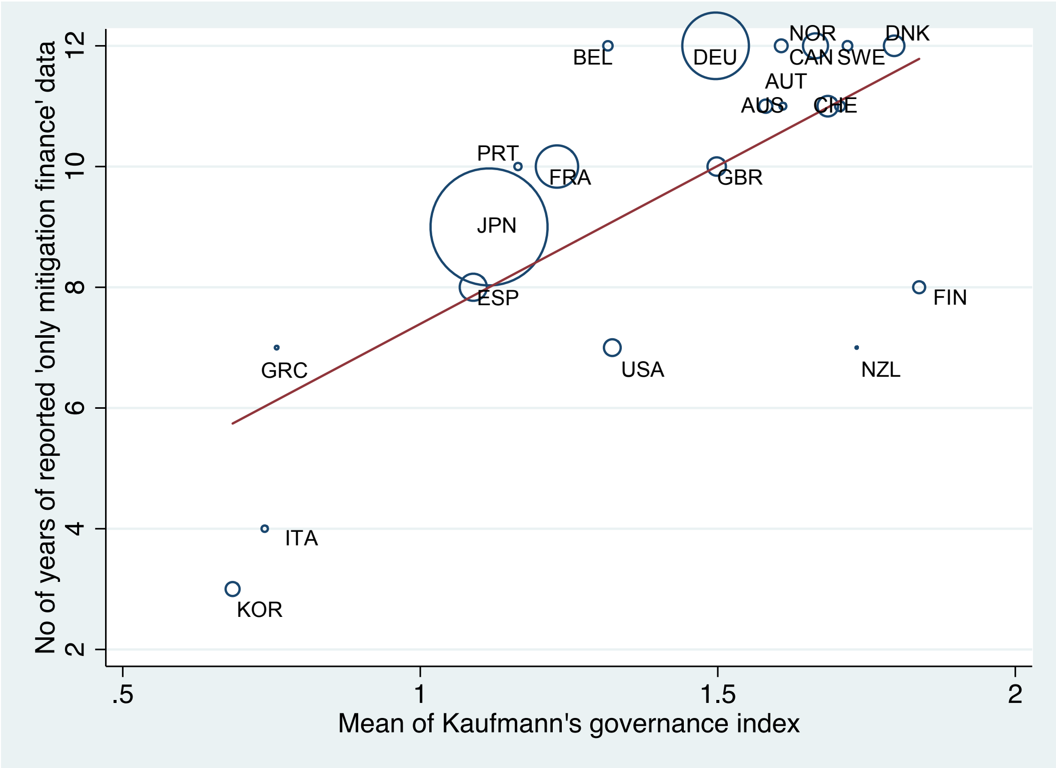


Figure 2.4. Number of reporting years by each donor for each Rio Marker objective



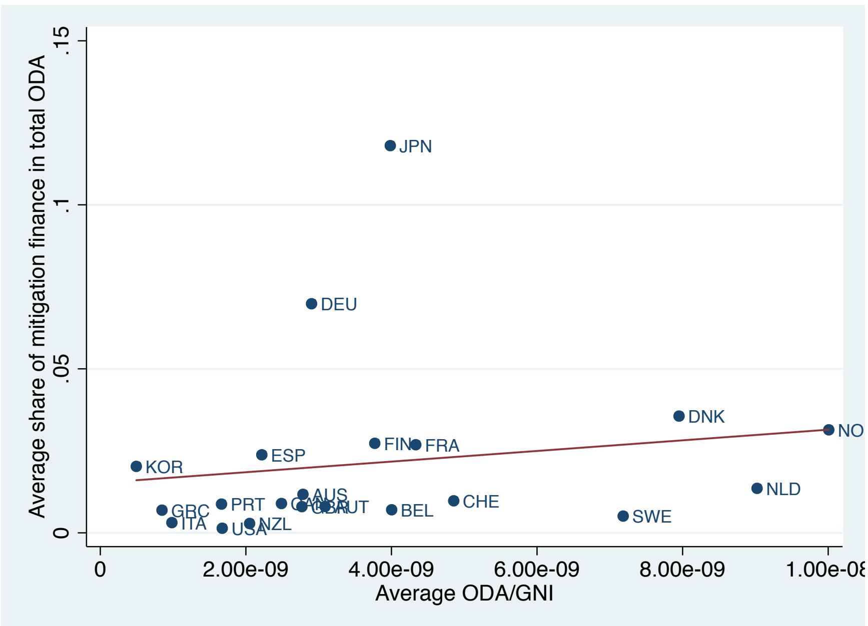
Donors' under-reporting behaviour may lead to a biased judgment on who are the greenest donors – the higher intensity of reporting reflecting the higher financial contribution to mitigating global emissions. While the extent of this bias is not fully reflected in Figure 2.5. Japan for instance, it has the largest contribution among all donors indicated by the size of the circle although it only has nine years of mitigation finance commitment since it reported its mitigation finance to OECD only from 2002 onwards. This is a significant contrast with some donor countries, such as Belgium, Norway, Sweden, Denmark that fully reported their mitigation finance contributions during that 12 year period. Their average contribution is tiny relative to those of Japan and Germany. Despite their small average annual contribution in absolute terms, donors who have fully reported their mitigation finance contribution from 1998-2009 are those whose ODA/GNI targets are the highest among other donors (Figure 2.6). Norway, Netherlands, Denmark, Sweden have surpassed the 0.7% ODA/GNI target and may have extra aid to be spent on improving their aid administration and reporting system.

Figure 2.5. Distributional pattern of donor reporting against donor's governance and the annual average of mitigation finance (1998-2009)



Note: the size of the circle represents the annual average of absolute mitigation finance in constant US$ 2009 prices

Figure 2.6. Distributional pattern of donors' allocation to mitigation finance and their ODA commitment/GNI target (1998-2009)



Donors' level of readiness to implement the OECD CRS and the heterogeneity of perceptions of what can and should be categorised as climate change mitigation are some of the factors that may cause underreporting. The latter may also be a cause of possible misalignment of reporting, where the true objective of a development activity does not fully match the OECD CRS criteria. Michealowa and Michaelowa (2011) discuss this over-reporting due to the high number of the mismatched reports according to Michealowa and Michaelowa's self-defined criteria.

The donors and OECD's level of readiness to report and facilitate data collection on ODA activities based on the Rio objectives is a major issue in the early years of the OECD CRS data. The OECD's guidelines are not sufficiently specific: for instance, there is no example of what mitigation finance should not pay for. This is becoming a contentious issue, with some donors disagreeing with the use of mitigation finance (as part of ODA) to improve the efficiency of energy use at coal-fired power plants, for example.

The voluntary arrangement for ODA and voluntary reporting under the Rio Marker system, together with the heterogeneity of donor's perspectives (Berthélemy, 2006), may result in donor's wide deviations from the normative practice parameters of ODA and the criteria of the OECD Rio Markers. Understanding how different donor characteristics influence their allocation practice is essential to improving the effectiveness of mitigation finance so that it can achieve its intended normative objective of mitigating global emissions. The following section explains how and why some donors' characteristics may influence their allocation of funding to mitigating emissions. The analysis following the next section uses the imperfect underreported data discussed in here with the caveat that it may not accurately estimate the degree to which significant determinants influence donors' decisions about allocating mitigation finance.

2.4. Hypotheses

Several factors representing donor characteristics have been accounted for having possible influence on the proportion of mitigation finance in total ODA. These factors are donors' carbon emission levels, income per capita, good governance, dominant political views, domestic spending on environmental issues, total population, the level of democracy, commitment to the Kyoto Protocol and other factors related to domestic environmental policies such as donors' energy efficiency and the proportion of alternative energy in energy mix.

A country's GHG emissions are central to the UNFCCC and need to be limited in order to mitigate climate change. The provision of finance to mitigate global GHG emissions and a country's associated responsibilities remain debatable and contentious within international climate change negotiations. The UNFCCC underpins these negotiations and indicates which factors determine the responsibility of a country for financing GHG emission reduction activities. The preamble to UNFCCC (1992) states:

> *…the largest share of historical and current global emissions of greenhouse gases has originated in developed countries, that per capita emissions in developing countries are still relatively low and that the share of global emissions originating in developing countries will grow to meet their social and development needs.*

Developed countries and their emission levels appear to be one of the causes of current climate problems. The statement above also acknowledges that there is a need to address developing countries' increasing GHG emissions caused by economic activities in order to fulfil their social and development needs. The UNFCCC's article 3 further presents a list of principles to which international efforts to protect climate systems should adhere and which should be implemented '*on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities*' (UNFCCC, 1992).

The UNFCCC (1992) guides its parties especially developed countries, to consider per capita GHG emissions as one of the key measurements guiding their efforts to protect climate systems. Article 3 to some certain extent provides a general framework for a burden-sharing mechanism that is weighted based on countries' responsibilities and capabilities. While both developed and developing countries are responsible for protecting climate systems, developing countries often argue that they are not capable of taking the lead due to their lack of capacity to finance and implement emission mitigation activities (den Elzen & Höhne, 2008).

Developed countries have taken action to provide finance for climate projects in developing countries. The UNFCCC provide a general framework to guide this action, but nevertheless the convention is not expressed in a way that can regulate, for example, how much each country should pay for overseas mitigation activities according to their GHG emission levels. To date, discussion of the incremental or additional costs of reducing GHG emissions in developing countries to which developed countries can partly or fully contribute is not conclusive (Olbrisch *et al.*, 2011).

To improve understanding of how developed countries' financing has responded to the UNFCCC statements guiding its provision, this chapter tests the effect of CO_2 emissions, the major component of GHG emissions, on mitigation finance. For consistency with the UNFCCC convention statement, donors' emission levels are measured on a per capita basis. The data on per capita CO_2 emissions were produced by Boden *et al.* (2011) and the rest of the GHG data are taken from the UNFCCC (2013).

Hypothesis #1: The higher the CO_2 (GHG) emission per capita in a DAC donor country, the higher the proportion of mitigation finance in its total ODA

Donor's economic capabilities, in this study represented by level of income per capita, is one of important factors in the global effort of mitigating GHG emissions. The UNFCCC's Article 3 (UNFCCC 1992) acknowledges that a country's respective capabilities is an important variable that should be considered in determining a country's responsibility for contributing to global emission reductions. Per capita income indicates a country's general economic conditions and capabilities. A country with a higher income level may have the capacity to pay for activities supporting global GHG emission reductions, such as energy efficiency programmes and helping developing countries to shift toward low-carbon development.

The positive and statistically significant relationship between income per capita and green and brown environmental aid provision is presented in the study by Hicks *et al.* (2008) (see the definitions of green and brown aid in section 1.2, Figure 1.3). They use GDP per capita to represent the level of donor countries' wealth. The data on income per capita used for the analysis in this chapter are provided by the World Bank's World Development Indicators database (WDI, 2011). In reporting climate projects, wealthy donors are also more capable than less wealthy donors of paying administrative costs such as those related to the measurement, reporting and verification (MRV) of climate finance. To identify whether developed countries' mitigation finance supply and reporting performance are positively influenced by their income per capita, this chapter tests

Hypothesis#2: The higher the GDP per capita of a DAC country, the higher the proportion of mitigation finance in its total ODA

Having good governance in place demonstrates a country's capability to plan, manage and implement sound administration and policies. Not all countries can rely on economic capability alone to mitigate global emissions; some other factors are relevant to support its implementation. The preamble of the UNFCCC (1992) paragraph 6 acknowledges that

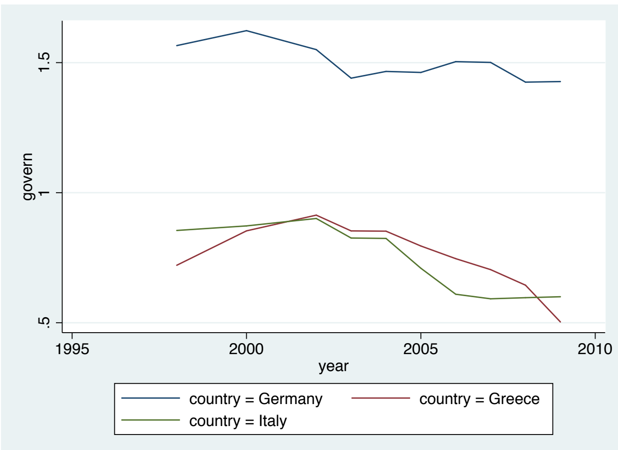
> *…the global nature of climate change calls for the widest possible cooperation by all countries and their participation in an effective and appropriate international response…*

To achieve an 'effective and appropriate international response', donors' other capabilities, such as their good governance practices, become relevant, as in reporting, recording and estimating GHG emissions. Hicks *et al's* (2008, p. 174) study of environmental aid allocation does not include or test donors' institutional capacity. Governance may have no obvious reason to include a governance variable in the case of environmental aid. In the case of mitigation emissions more specifically, a strong capacity for measurement and reporting at home may motivate donors to provide mitigation finance and to transfer knowledge and assistance to implement this in overseas countries. For example, the UK has a domestic climate mitigation programme for measuring and estimating future emissions. The country has created partnerships with ten developing countries to promote the use of this tool in supporting low-carbon development (DECC, 2014).

Developed countries, with their institutional experience especially in setting effective and functioning regulatory framework and enforcing law, are capable of assisting developing countries to develop and implement sound policies. Mitigation finance can be used to pay for providing technical assistance and relevant experts to transfer knowledge in building good administration practices (Meehl *et al.,* 2007 p. 1393). Donor countries with effective administration also have the ability to fulfil the administrative requirements for funding climate mitigation projects, such as preparing measurement, reporting and verification (MRV) reports and reporting climate change projects according to the OECD's CRS guidelines.

To identify whether developed countries with better institutional capability provide more mitigation finance, this chapter tests the relationship between donors' supply of mitigation finance and the average of six of Kaufmann's institutional indices (Kaufmann *et al.*, 2011). These indices are regulatory quality, rule of law, voice and accountability, corruption control, political stability, and government effectiveness. All six indices capture all the broader dimensions of the quality of governance. Each index ranges from -2.5 to 2.5, with higher values corresponding to higher quality. All of these institutional variables are strongly correlated with one another (see Appendix 2.3). To avoid multicollinearity, the variables are not inserted into the same specification simultaneously and their impact on mitigation finance is tested separately. Testing all six of Kaufmann's indices separately is a significant contribution of this chapter. Some might argue that they vary less across time, in a developed country that is relatively stable and where good governance has been a common practice. Easterly and Williamson (2011) show there are different levels of performance across donor agencies in terms of reporting to the OECD. The data used in this chapter also show that the level of governance varies across donors. Figure 2.7, below, shows that Germany has higher governance indices than Greece and Italy.

Figure 2.7. Trends of Germany, Italy and Greece's Kaufmann's governance indices



Hypothesis #3: The better the governance in a DAC country, the higher the proportion of mitigation finance in its total ODA

Donor governments' main political views tend to influence their strategic and political decisions, such as decisions about the relative importance of environmental issues like climate mitigation in their national and international agenda. Neumayer (2004) finds that left-wing parties and individuals are more pro-environment than their counterparts: donor governments with more left-wing representatives tend to have stronger environmental policies. This inclination of countries with strong leftist parties to have sound environmental policies might influence the allocation of aid to mitigate GHG emissions positively.

Hicks *et al.*'s (2008) study unexpectedly finds that leftist party strength in donor governments has little relevance in decisions about the allocation of green aid. They argue that this unexpected outcome is possibly due to legislatures being pressurised by local and national environmentalists to spend money at home. This chapter includes more recent data than that used by Hicks *et al.* (*ibid*) and tests for the positive influence of the strength of leftist governments on the donor government's provision of mitigation finance to developing countries. The data on the political orientation of the government are obtained from the Database of Political Institutions (DPI) (Keefer, 2010), which uses a coding system to classify party orientation with respect to economic policy: (1) denotes governments defined as conservative, Christian democratic or right-wing; (2) denotes centrist governments and (3), those that are communist, socialist, social democratic or otherwise left-wing. Leftist governments might also allocate an environmental budget to tracking environmental activities. The supply of mitigation finance is expected to increase with the stronger leftist government that is shown by a positive relationship between the DPI coded data and mitigation finance provisions.

Hypothesis #4: The higher the number of left-wing party seats in the parliament of a DAC country, the higher the proportion of mitigation finance in its total ODA

Money for environmental projects that is spent at home can influence the availability of funding for overseas environmental projects. Hicks *et al*. (2008) argue that developed countries with strong leftist governments can be pressured by labour and environmentalists to spend their environmental budget at home. To control for the funding division between home and overseas mitigation spending, the proportion of environmental spending at home out of total government national spending is included as part of the hypothesis testing. Data are provided by the International Monetary Fund's (IMF, 2010) Government Finance Statistics (GFS).

Hypothesis #5: The higher the proportion of environmental spending in the total budget of a DAC country, the higher the proportion of mitigation finance in its total ODA

The size of a donor country's population can represent the volume of development aid that the country is able to provide. Every dollar of official aid originates from tax that citizens pay to their government. When the government puts aside a proportion of tax as foreign aid and as mitigation finance, the amount of ODA and mitigation finance provided by donors is supposedly reflecting the volume of the financial contributions of their population and taxpayers. The size of the population is tested and included in the main econometric model as a control variable. Data on population are taken from World Development Indicators (WDI) (WDI, 2011).

Hypothesis #6: The larger the population of a DAC country, the higher the proportion of mitigation finance in its total ODA.

Democratic governments are found to exhibit stronger commitment to the environment than non-democratic governments (Neumayer, 2002). Level of democracy is likely to be a determining factor in the provision of mitigation finance as part of total ODA and is tested in the robustness checks. Democracy is measured using the 0-10 index from the Polity IV dataset (Marshall *et al.*, 2011), with larger values corresponding to higher levels of democracy).

Hypothesis #7: The more democratic a DAC country, the higher the proportion of mitigation finance in its total ODA

This study includes several additional variables to conducted robustness checks, namely CO_2 intensity per unit of GDP (hereafter 'CO_2 intensity'), the proportion of alternative energy use from total energy mix, and the ratification status of Kyoto Protocol. CO_2 intensity is not included in the main specification because it is not one of six official emission measurements (CO_2, N_2O, SF_6, CH_4, PCFs, HFCs) listed under the Protocol. However it is useful to indicate how efficient is a country in using energy to produce one unit of domestic product. Donor countries with lower energy intensity may have higher motivation to improve energy efficiency overseas due to a cost boundary to improve their efficiency even further. The data of CO_2 intensity is taken from WDI (2011).

Hypothesis #8: The lower CO_2 intensity per unit of GDP in a DAC country, the higher the proportion of mitigation finance in its total ODA

The proportion of alternative energy use from total energy mix (WDI, 2011) indicates to what extent donor countries have domestically implemented green energy policy. The countries with better implementation of green energy policy will have higher incentive to motivate other developing countries for following their actions. Donors might see their increasing investments in alternative energy at their home country will not be effectual globally if the emissions of other developing countries keep increasing without any preventive action. Overseas mitigation finance can be used as a mean to introduce to developing countries the initial effort of burden sharing of mitigation global emissions.

Hypothesis #9: The higher proportion of alternative energy use in total energy mix in a DAC country, the higher the proportion of mitigation finance in its total ODA

Some developed countries that have ratified the Kyoto Protocol have an obligation to meet the emission reduction target stated in the document and report their progress to the UNFCCC. To test whether such responsibilities influence or pressurise donors to provide a higher proportion of mitigation finance in total ODA, a 0-1 dummy variable (*kyotoprot*) for the year after the respective donor's ratification of the Kyoto Protocol is included to capture this dimension. Data are taken from the Environmental Treaties and Resource Indicators (CIESIN-SEDAC, 2011). Due to its invariant characteristic, this variable is only included in the estimation using random effect model.

Hypothesis#10: A DAC donor that has ratified the Kyoto Protocol is more likely to have a higher proportion of mitigation finance in its total ODA.

2.5. Methods

This section presents the methods applied to identify the extent to which donor characteristics influence mitigation finance provision. Multivariate regression analysis is relevant for identifying whether there is a relationship between donor characteristics and their provision of mitigation finance. Although the UNFCCC's (1992) framework and principles set out how developed and developing countries should respond to negative effects of climate change, most of its terms that determine a country's responsibility for paying for global emission reduction, such as 'common but differentiated responsibilities' are not operationalised or measured. To date, developed and developing countries have not yet agreed upon common measurements for weighing a country's responsibility to pay for its national and global GHG emission reduction.

In this uncertain situation, selected quantitative research methods using the econometrics explained below suit the purposes of this investigation. The fixed-effect model and random-effect model are the two main econometric techniques employed here to identify the extent of the influence of a set of variables representing donors' characteristics on the proportion of mitigation finance in their total provision of ODA. Both models are presented to show the consistency of the results of the two estimations.

2.5.1. Fixed-effect model

The fixed-effect model (FEM) estimates the relationships between variables representing donor characteristics and the provision of mitigation finance in total ODA commitment and disbursement, A_{it}^{j}. These donor characteristics are the level of CO_2 emissions per capita, E_{it}, the level of wealth, measured by income per capita, I_{it}, governance, G_{it}, the composition of left or right representative in the national parliament, L_{it}, the proportion of environmental expenditure in the government budget, X_{it}, and a vector list of other explanatory variables, Z_{it} as seen in Eq. (1) below.

$$A_{it}^{j} = \propto_0 + \propto_1 E_{it} + \propto_2 I_{it} + \propto_3 G_{it} + \propto_4 L_{it} + \propto_5 X_{it} + \propto_6 Z_{it} + a_i + \varepsilon_{it} \qquad (1)$$

The superscript *j* of the dependent variable A_{it}^{j} on the left-hand side denotes different measures of mitigation finance; namely the proportion of mitigation finance in a country's total aid commitment, the proportion of mitigation finance in its total aid disbursement, the logarithm of mitigation finance commitment and disbursement, $\ln A^c$ $\ln A^d$, the disbursement-commitment ratio $\frac{A^d}{A^c}$, the logarithm of mixed mitigation finance commitment $\ln A^{MIX}$, and the proportion of mixed mitigation finance in a country's total aid commitment. The period of analysis for the commitment regressions is 1998-2009, and that for the disbursement and the disbursement-commitment ratio is 2002-2009. All absolute nominal values are in logarithmic form.

When FEM is used as the estimator, a_i, as shown in eq. (1), automatically controls for unobserved and time-invariant variables. For example, these variables can be a country's geographic location or the existence of climate change sceptics in a country's population. These country characteristics tend to be fixed and unchanging over time. The inclusion of time-invariant variable in the main specification is unnecessary, since STATA will automatically drop it when the estimation is performed. For robust and unbiased results the FEM's idiosyncratic error, ε_{it}, should not correlate with each of the regressors, but FEM allows for arbitrary correlation between a_i and the regressors in any time period, just as with first differencing (Cameron & Trivedi, 2005, p.482).

2.5.2. Random-effect model

REM is often used as the alternative to FEM when the factors that may influence the dependent variables tend to vary over time. Unlike FEM, which controls for unobserved fixed effects, a_i, REM controls for unobserved random and variant variables, denoted by a_i (Baltagi, 2003, pp. 12-16). The Hausman test is often used to compare FEM and REM and to make a value judgment on which of the two is an apt estimator for a set of variables included in the main specification. The null hypothesis of the Hausman test is that the unobserved effect does not correlate with the explanatory variables. When this null hypothesis is not rejected, both models can be used for the estimation and should yield similar coefficients. The rejection of the null hypothesis suggests that FEM is the appropriate estimator, as REM makes an assumption that unobserved random effects are orthogonal to the explanatory variables, and the violation of this assumption leads to biased estimation results.

The results of the Hausman test show that when time is not controlled for in the FEM, as time dummies are automatically dropped in STATA, the chi-square and p-values are below zero. When the specification includes all the variables tested in the robustness checks, the Hausman test finds the chi-square and p-values equal to 34.28 and 0 respectively, indicating that FEM is a better estimator than REM, as the latter allows for arbitrary correlation between a_i and any explanatory variable in any time period. For example, FEM allows for unobserved fixed effects such as the fact that the existence of climate change skeptics in the country influences government decisions about the allocation of mitigation finance. The Hausman test does not allow for testing the specification using robust option, therefore the results of the FEM and REM are presented in a comparable format to facilitate analysis of the sign consistency of coefficients of observed explanatory variables. To control for heteroscedasticity, 'robust' is included at the end of the STATA command.

To avoid the model leading to biased estimates, a correlation test is performed prior to the collinearity test. The correlation between total ODA and GDP per capita is relatively high (see Appendix 2.3 for the correlation matrix). Collinearity tests between explanatory variables are performed using variance inflation factors (VIFs) ranging from 1.14 to 2.96 and below 10, indicating low levels of collinearity (Puhani, 2000). Lower variance inflation factors may lead to a higher likelihood that the model produces robust estimations.

2.6. The empirics of mitigation finance supply

Earlier empirical analyses have adopted a similar empirical framework for other types of aid. Chong and Gradstein (2008) employ donor fixed-effects panel regressions and cross-country regression analysis to identify the impact of donor characteristics on the total amount of aid given. Hicks *et al.* (2008) use both pooled ordinary least squares (OLS) and fixed-effects panel regressions to estimate the effect of donors' political and economic characteristics on the amount of environmental and non-environmental aid given. This chapter compares the results of FEM and REM to identify what determines the proportion of mitigation finance in total ODA. This is a major improvement on the study by Hicks *et al.* (2008), which only applies pooled OLS and FEM and tests the absolute amount as the dependent variable. Additionally, later in the chapter some alternative estimations are performed using different dependent variables, namely the amount of mitigation finance committed and disbursed, the disbursement-to-commitment ratio and the volume of total mitigation finance that includes biodiversity and desertification co-benefits. These alternatives offer a range of information on how each component of a donor's characteristics that is statistically significant determines its provision of mitigation finance.

Table 2.2 presents the estimation results of the explanatory variables that may influence the proportion of mitigation finance in total ODA provision. Column 1 (hereafter 'c1') has a number of explanatory variables. *lnco2pc* and *lngdppc* measure the logarithm of CO_2 emissions per capita and GDP per capita respectively. CO_2 emissions representing donors' emission level (*lnco2pc*) which is an important measurement of controlling and limiting climate change stated in the UNFCCC, is statistically significant. When the variables democracy (*democracy*), CO_2 intensity (*co2inten*), alternative energy (*altenergy*) and Kyoto Protocol (*kyotoprot*) are included in the robustness checks (c2) the coefficient of *lnco2pc* becomes insignificant. These additional explanatory variables are all significant except for democracy. CO_2 intensity seems to be a stronger determinant than per capita emissions in influencing the proportion of mitigation finance in total ODA.

When *lnco2pc* is insignificant in the robustness checks, emissions per capita representing the 'differentiated responsibility' of individual emissions or per-capita-emissions do not have a consistent influence on the allocation of mitigation finance in total aid provision. Instead, economic output is a more relevant indicator of differentiated responsibility. CO_2 intensity per unit of GDP significantly influences the provision of mitigation finance at the 1% level; the higher the CO_2 intensity of donor countries, the higher the proportion of mitigation finance in their aid provision, *ceteris paribus*. Mitigation finance provision also positively correlates with the proportion of domestic use of alternative energy in the donors' energy mix (*altenergy)*: the higher the domestic use of alternative energy, the higher the provision of mitigation finance in total ODA. Mitigation finance makes up a higher proportion of total ODA provision in donor countries with greater responsibility for reducing emissions due to their intensive economic activity, and in those with greater capacity to reduce emissions by using alternative energy domestically.

Table 2.2: Determinants of mitigation finance in total ODA provision

Dependent variable: Share of mitigation finance in total ODA (commitment), 1998 to 2009	Fixed effect (1)	(2)	Random effect (3)	(4)
lnco2pc	0.019**	0.001	0.019***	0.001
	(2.947)	(0.077)	(2.819)	(0.074)
lngdppc	-0.004	-0.002	-0.004	-0.002
	(-0.315)	(-0.094)	(-0.301)	(-0.090)
govern	0.031***	0.055***	0.031***	0.055***
	(4.755)	(7.138)	(4.549)	(6.819)
leftgov	-0.003**	-0.004**	-0.003**	-0.004***
	(-2.373)	(-2.891)	(-2.270)	(-2.762)
environexpen	-0.024**	-0.028**	-0.024**	-0.028**
	(-2.405)	(-2.445)	(-2.301)	(-2.336)
lnpop	0.009***	0.009**	0.009***	0.009***
	(3.322)	(2.867)	(3.178)	(2.739)
democracy		0.000		0.000
		(0.019)		(0.018)
co2inten		0.040***		0.040***
		(5.228)		(4.994)
altenergy		0.001**		0.001***
		(3.071)		(2.934)
kyotoprot			0.066***	0.068***
			(12.924)	(10.435)
R-Squared (overall)	0.112	0.156	0.441	0.520
R-Squared (between)	0.436	0.350	1.000	1.000
R-Squared (within)	0.256	0.361	0.256	0.361
N	113	113	113	113

Notes: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

The level of a donor's income per capita is negatively correlated with its provision of mitigation finance, although this relationship is not statistically significant in Table 2.2 (c1). This indicates that level of wealth does not motivate some donors to allocate a higher proportion of mitigation finance in their total aid provision, other things being equal. One might disagree with the use of GDP per capita as a proxy of donors' wealth and instead suggest including the amount of GDP in the main specification, controlling it by including total population. This chapter includes GDP per capita in the main specification in order to compare it with its effect on brown and green aid provision (Hicks *et al*., 2008). While the findings in this chapter show no evidence of a relationship between GDP per capita and mitigation finance commitment, Hicks *et al.* (2008) point that there is a positive relationship in the case of green aid that is significant at 5%. However, their estimation is based on pooled OLS and is not controlled for fixed effects.

A measure of good governance that captures a donor government's institutional capacity and capability for effective administration and formulating and implementing sound policies and regulations (*govern*) is found not be significant. The coefficient of *govern* is significant at 1% (c1). The result is robust across the robustness check (c2). The estimation using REM also shows a stable and significant result (c3, c4). While *lngdppc*, representing economic capacity, is insignificant, here the effect of the donors' level of governance, indicating their institutional *capability*, strongly influences the allocation of mitigation finance as a proportion of total ODA provision. There is a positive trend of donors that perform better in managing different aspects of governance at home paying more attention to solving global climate problems.

An index capturing the political orientation of the donor government, with higher values corresponding to more left-wing government orientation (*leftgov*) is negative and significant at 5%. This is significant and robust across the robustness checks and the alternative estimation model (c2-c4). This finding contradicts that of Neumayer (2003) that the strength of a leftist government is a significant positive influence on domestic environmental conditions, leading to a lower level of pollution. As Hicks *et al.* (2008) argue, leftish donor countries may be pressurised by local green NGOs and environmentalists to spend their financial resources at home rather than overseas.

This is consistent with the negative relationship between the proportion of domestic environmental spending in total expenditure and the proportion of mitigation finance allocated in total ODA. This new variable controls for environmental spending between a donor's homelands and overseas, using the proportion of environmental expenditure in the government budget. One-unit decrease in *environexpen* tends to cause a 1% drop in the proportion of donor environmental expenditure, corresponds approximately to a 2.4% rise in mitigation finance. This result indicates that a donor's domestic environmental spending may involve a trade-off. Competition between domestic and overseas green projects for financial resources and increasing pressure from domestic environmental NGOs may deter leftish governments from spending money on overseas green projects that will have little and indirect effect on their electorates. Mitigation finance can also be seen as a policy instrument that supports the internationalisation of the domestic environmental policy of leftish donor countries (see e.g. Busch & Jörgens, 2007; Keohane & Milner, 1996; Keohane, 2011; Tews, *et al.*, 2003). It seems that competition for financial resources may restrict donor countries which are experiencing pressure to be green at home from prioritising aid-giving policy that support greening policies in overseas developing countries.

Population (*lnpop*) is included as a control variable. Table 2.2 shows that there is a statistically significant positive correlation between donor population (*lnpop*) and mitigation finance commitment, as expected (i.e. the more tax-payers and consumers in the donor's homeland, the higher its contribution of mitigation finance in its provision of international aid).

When mitigation finance is measured as an absolute value the total amount of ODA committed is controlled for (Appendix 2.4). Total ODA (*lntotaloda*) is the only significant determinant of the amount of mitigation finance, so the larger volume of overall ODA is the main influence in the increase of mitigation finance.

Table 2.3 shows the relationships between the GHGs listed by the UNFCCC other than carbon dioxide (*lnco2pc)*, namely methane (*lnch4pc),* perfluorocarbons (*lnpfcspc*), hydrofluorocarbons (*lnhfcspc*) sulphur hexafluoride (*lnsf6pc*) and nitrous oxide (*lnn2opc*). They are all in logarithmic form and measured on a per capita basis. The carbon dioxide is included in the estimation since it is the main component of the GHG. The results show that the highest global warming potential emissions, namely hydrofluorocarbons, perfluorocarbons *and* sulphur hexafluoride, appear to be negative determinants of donors' supply of mitigation finance. The coefficients of these variables in specifications c7, c8 and c9 (Table 2.3) are all negative and significant, and the coefficients of *lnpfcspc* and *lnsf6pc* are highly significant at 1%.

Table 2.3: Determinants of mitigation finance commitment: individual GHG variables

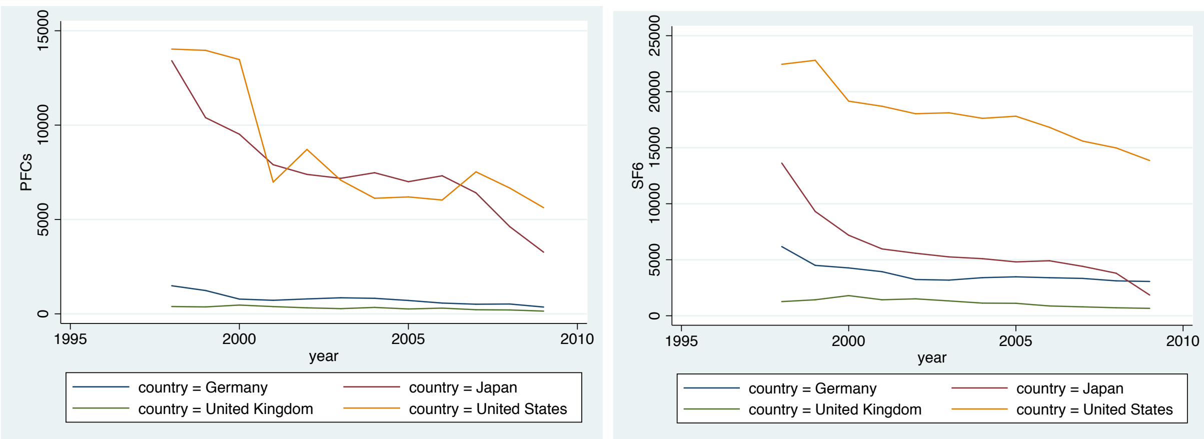
Dependent variable: Share of mitigation finance in total ODA (commitment), 1998 to 2009	(5)	(6)	(7)	(8)	(9)	(10)
lnco2pc		0.017*	0.020**	0.013*	0.017*	0.016*
		(2.175)	(2.694)	(1.970)	(2.179)	(2.031)
lnghgpc	0.009***					
	(3.550)					
lnch4pc		0.008				
		(1.169)				
lnhfcspc			-0.010*			
			(-2.064)			
lnpfcspc				-0.005***		
				(-5.322)		
lnsf6pc					-0.006***	
					(-3.589)	
lnn2opc						0.010
						(1.143)
R-squared (overall)	0.120	0.104	0.085	0.277	0.174	0.095
R-squared (between)	0.376	0.444	0.536	0.330	0.111	0.464
R-squared (within)	0.252	0.258	0.269	0.332	0.280	0.259
N	107	107	107	106	107	107

Notes: *lngdppc, govern, leftgov, environexpen* and *lnpop* are included but not presented. The results are robust across estimation models. The estimation with REM (available upon request) produces stable signs and statistically significant results for all significant coefficients. Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level respectively.

To some extent this may reflect donor countries' domestic and international strategies for mitigating global emissions. Countries that make serious attempts to mitigate their most dangerous emissions into the global atmosphere at home tend to provide more official international finance to reduce emissions abroad, although, interestingly, they have a high concentration of carbon dioxide per capita.

Donors may start by mitigating the most dangerous GHG emissions at home, which is relatively easy to deal with politically. While mitigating CO_2 at home country is complex and involves all industries, as it is the mostly widely-produced GHG and the result of various types of human and industrial activities, emissions of hydrofluorocarbons (*lnhfcspc*), perfluorocarbons (*lnpfcspc*) and sulphur hexafluoride (*lnsf6pc*) are relatively small compared to those of CO_2 and are specific to certain industries. The specific nature of these gases allows donor governments to make specific interventions to mitigate them; for instance Japan and the US have demonstrated the mitigation of SF_6 and PFCs since 1998 (Figure 2.8).

Figure 2.8. Trends of perfluorocarbons and sulphur hexafluoride of Japan, the US, the UK and Germany



The current climate change negotiations under the UNFCCC can able to draw lessons from the past success at abolishing PFCs and HFCs. The two gases were finally phased out a few years after the 1985 Vienna Convention and its consequent follow-ups: the 1990 London and the 1992 Copenhagen Amendments to the Montreal Protocol to accelerate the phasing out of 15 CFCs (by 1996). These conventions are discussed in the next chapter.

Table 2.4 presents the corresponding estimates when the specification of c1 in Table 2.2 is replicated to test six sub-indicators of Kaufmann's World Governance indicators (*govern*). All the indices have positive correlations with the proportion of mitigation finance in overall aid provision. Among all the governance indices, four determine mitigation finance provision: regulatory quality, rule of law, voice and accountability, and control for corruption. Table 2.4 shows that the variables representing these aspects – *regulquality* (c11), *ruleoflaw* (c12), *voiceaccount* (c13), and *contcorrupt* (c14) – are all positive and significant at 1%. The other two indices, political stability and government effectiveness, are insignificant determinants of mitigation finance provision. The ability of donors to having functioning law and regulatory aspects positively influences the proportion of mitigation finance in their total ODA, while political turmoil and the quality of public service at home are not relevant determining the proportion of mitigation in total aid provision.

Table 2.4: Determinants of mitigation finance: institutional variables

Dependent variable: Share of mitigation finance in total ODA (commitment), 1998 to 2009	(11)	(12)	(13)	(14)	(15)	(16)
lnco2pc	0.013**	0.023***	0.020**	0.020**	0.021***	0.021***
	(2.472)	(3.367)	(3.149)	(3.050)	(3.427)	(3.391)
lngdppc	0.014	-0.014	-0.007	-0.008	0.014	0.011
	(1.424)	(-1.115)	(-0.548)	(-0.649)	(0.965)	(0.836)
leftgov	-0.004**	-0.003**	-0.003*	-0.004**	-0.003*	-0.003
	(-2.534)	(-2.618)	(-2.076)	(-3.013)	(-1.868)	(-1.698)
environexpen	-0.026**	-0.024**	-0.022*	-0.026**	-0.015	-0.017
	(-2.477)	(-2.662)	(-2.120)	(-2.621)	(-1.634)	(-1.654)
lnpop	0.007**	0.009***	0.011***	0.009**	0.011**	0.008**
	(2.781)	(3.411)	(3.807)	(3.143)	(3.078)	(2.880)
regulquality	0.024***					
	(4.190)					
ruleoflaw		0.031***				
		(6.226)				
voiceaccount			0.062***			
			(5.055)			
contcorrupt				0.020***		
				(7.306)		
polstability					0.020	
					(1.439)	
goveffective						0.010
						(1.479)
R-squared (overall)	0.145	0.150	0.131	0.126	0.099	0.105
R-squared (between)	0.207	0.286	0.153	0.364	0.738	0.470
R-squared (within)	0.225	0.286	0.280	0.277	0.213	0.193
N	113	113	113	113	113	113

Note: The results above are robust across estimation models. The estimation with REM (available upon request) produces stable signs and statistically significant results for all significant coefficients. Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level respectively.

It is possible that donor countries with better regulatory quality have a good environmental regulatory system and a functioning legal system which promote the implementation of green policies at home as well as in other countries. Countries with a good accountability system that also perform well in facilitating public debate may have greater public awareness of global environmental issues. Citizens' voices may influence their government representatives to be concerned with global environmental problems that affect them.

2.7. From the determinants of rhetoric to actual provision: mitigation finance commitment and disbursement gaps

In Table 2.5 the focus switches from mitigation finance commitment to its disbursement. Data on mitigation finance disbursement are available only from 2002 onwards, hence there are has a fewer observations than those on commitment, which may affect the ability of its outcomes to result in unbiased estimations.

Although the results for disbursement may not be as robust as those of commitment, the significant difference between the two signals the gap between donors' rhetoric and actions. This gap is apparently consistent across robustness checks and across estimators. When the FEM is applied, regression of mitigation finance disbursement in Table 2.5, c20 shows that only the income per capita variable is significant. Donors' financial capacity becomes the only determinant of mitigation finance provision in total ODA, and the correlation is positive. The other variables become insignificant. When it comes to actual payment, domestic income per capita becomes more relevant than other variables which were significant in the earlier commitment stages. These variables, namely emissions per capita, domestic governance, donors' environmental budget and donors' political view, are irrelevant determinants at the disbursement stage.

Table 2.5: Determinants of mitigation finance disbursement

Dependent variable: Share of mitigation finance in total ODA (disbursement), 2002 to 2009	Fixed effect (20)	(21)	Random effect (22)	(23)
lnco2pc	-0.004	-0.003	-0.004	-0.003
	(-0.490)	(-0.208)	(-0.470)	(-0.199)
lngdppc	0.024*	0.018	0.024**	0.018
	(2.133)	(1.663)	(2.046)	(1.592)
govern	-0.005	0.001	-0.005	0.001
	(-0.588)	(0.130)	(-0.563)	(0.124)
leftgov	0.002	0.001	0.002	0.001
	(0.933)	(0.451)	(0.895)	(0.432)
environexpen	-0.004	-0.003	-0.004	-0.003
	(-0.454)	(-0.278)	(-0.436)	(-0.266)
lnpop	0.001	0.001	0.001	0.001
	(0.194)	(0.195)	(0.186)	(0.187)
democracy		0.003		0.003
		(0.605)		(0.579)
co2inten		0.014		0.014*
		(1.832)		(1.754)
altenergy		0.001*		0.001*
		(1.936)		(1.854)
kyotoprot			0.043***	0.045***
			(13.918)	(15.620)
R-squared (overall)	0.112	0.070	0.362	0.381
R-squared (between)	0.795	0.448	1.000	1.000
R-squared (within)	0.043	0.072	0.043	0.072
N	94	94	94	94

Notes: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

To the check the consistency of this result, a robustness check adds three variables as in c2 (Table 2.2). The income per capita variable is insignificant and the alternative energy variable appears to be significant. This indicates that the proportion of alternative energy in the energy mix at home (*altenergy*) still influences the donor's actual allocation of mitigation finance in its ODA provision. The coefficient of the alternative energy variable becomes a significant determinant of mitigation finance disbursement at 10% (c21). The confidence level in disbursement is lower than that in commitment in c2, Table 2.2. This may be due to the lower number of observations on mitigation finance disbursement.

With REM the results are consistent. Only income per capita is significant and positive, but it is insignificant in another robustness check of mitigation finance that adds the Kyoto protocol (*kyotoprot*) as a dummy control variable. The coefficients of CO_2 intensity (*co2inten*) and alternative energy (*altenergy*) are significant determinants of mitigation finance disbursement as well as of the Kyoto Protocol variable (c23) *ceteris paribus*. Donor countries which have higher alternative energy provisions in their energy mix, but are less efficient at their energy use tend to allocate higher mitigation finance in their total aid disbursement.

2.8. Alternative dependent variables: volume, ratio and the volume of mixed mitigation finance provision

Testing some alternatives of dependent variables provides insights into what independent variables have similar effects on different aspects of mitigation finance namely: the determinants of the volume, the disbursement-commitment ratio, and the proportion of mitigation finance that includes funding addressing biodiversity and desertification. When the volume of mitigation finance replaces the proportion of mitigation finance in total ODA as the dependent variable and total ODA is controlled for, all the variables become insignificant except for total ODA itself, which is statistically significant at 5% (Table 2.6, c24). The increasing amount of mitigation finance is mainly determined by increasing total ODA and there is no evidence that it is driven by domestic environmental and social factors. The growing allocation of financial resources to ODA also makes more funding available for mitigation finance. This appears to be consistent in the disbursement of mitigation finance: the increase in total aid determines the increasing actual disbursement of mitigation finance (c25). However, in disbursement, GDP per capita is positive and statistically significant at 1%. Richer donors’ actual provision of mitigation finance may be higher than less rich donors because richer donors have more financial resources for mitigating global emissions, benefitting all countries.

Table 2.6: Alternative mitigation finance variables

Dependent variable	Log of mitigation finance commitment 1998-09 (24)	Log of mitigation finance disbursement 2002-09 (25)	Mitigation finance disbursement-commitment ratio 2002-09 (26)	Mixed mitigation finance commitment 1998-2009 (27)
lnco2pc	0.248	-0.719	17.388	2.342***
	(0.316)	(-0.938)	(0.720)	(7.728)
lngdppc	1.658	2.898*	-59.468*	-0.832
	(0.880)	(2.155)	(-1.902)	(-0.894)
govern	1.474	0.657	16.917	0.601
	(1.598)	(0.851)	(1.149)	(1.007)
leftgov	-0.197	-0.046	2.701	-0.236
	(-1.581)	(-0.287)	(1.810)	(-1.744)
environexpen	-0.411	-0.121	0.785	-0.381
	(-1.049)	(-0.184)	(0.113)	(-1.463)
lnodadisburse*	1.103**	0.763**	0.316	1.331***
	(2.317)	(2.646)	(0.064)	(9.474)
lnpop	0.210	0.121	-3.231	-0.307
	(0.396)	(0.316)	(-0.634)	(-1.549)
R-squared (overall)	0.445	0.438	0.122	0.441
R-squared (between)	0.195	0.832	0.145	0.012
R-squared (within)	0.487	0.459	0.131	0.524
N	113	94	90	118

Notes: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% level respectively. *lnodacommit in the case of commitment and disbursement-commitment ratio

The disbursement of mitigation finance has historically lagged behind its commitment (with a disbursement-commitment ratio $\frac{A^d}{A^c}$, for all donors in the range of 0.22–0.66). The lowest ratio indicates the poorest donors' performance in meeting their commitments. Specification c26 explores whether the magnitude of this ratio depends on donor characteristics. The statistical results are again weak, with *lngdppc* the only variable significantly (and negatively) affecting the ratio; in other words, while donor countries whose per capita income is relatively higher tend to commit a large amount of ODA allocated to mitigation finance, but have small disbursement and are further behind in terms of fulfilling their targets (Table 2.6, c26).

In c27, the commitment of *mixed mitigation finance* (as defined in section 1.3.1) is used as the dependent variable. Interestingly, here the variable of CO_2 emissions per capita influences the provision of total mixed mitigation finance. Higher CO_2 emissions in a donor country and greater total aid correspond to increased *mixed* mitigation finance commitment. Countries with high CO_2 emissions tend to provide a greater volume of mitigation finance with biodiversity and desertification co-benefits. Here, the identification of the relationship between income per capita and mitigation finance supply from this chapter is useful for reflecting whether the richer countries with higher economic capabilities provide a high volume of mitigation finance following the normative guidance in the 1992 UNFCCC that mitigating emissions is based on '*differentiated responsibilities and respective capabilities'*. One may associate the respective capabilities with economic capacities and if this is so it is conceivable that wealthier donors with greater economic capacity may consider themselves responsible for providing a greater supply of mitigation finance.

2.9. Conclusions

While donors' commitment to fund climate change activities has increased considerably over the last decade, some donor countries have responded more generously than others in supplying mitigation finance. To the author's knowledge, this is the first empirical paper attempting to explicitly probe the relationship between the provision of official mitigation finance and donors' characteristics. The data also show that in the early years of the CRS records some donor countries under-reported their supply of mitigation finance, but those who fully report it are not necessarily the major donors of climate mitigation finance in term of its volume. There is a tendency that donors with better governance tend to report to CRS, and most of these have achieved and surpassed the 0.7% ODA/GNI target. Good governance and donors' performance in alternative energy influence how much mitigation finance is allocated as part of total ODA provision, *ceteris paribus*. The econometric analysis shows that this is consistent across robustness checks. There is early evidence that increasing CO_2 emissions per capita motivates the donor to allocate more mitigation finance. Domestic emissions may not be a main determinant of the increasing allocation of mitigation finance in total ODA provision, as it is insignificant in some robustness checks. Instead, successful attempts to curb the most dangerous greenhouse gases and higher commitment to the Kyoto Protocol, all other things equal, tend to determine how much is the green allocation in ODA provision.

Various extensions of this analysis could be developed, and some of these are discussed in the following chapters. A possible extension of the analysis as a new line of study is a comparative study between mitigation finance and adaptation finance. The analysis of adaptation finance may shed light on any determinants affecting it differently from the identified determinants of mitigation finance in this chapter. However, data on adaptation finance have only recently become available, and it is beyond the scope of this thesis to include them in its analysis.

Some extensions covered in the next chapters focus on mitigation finance. Chapter 3 probes mitigation finance from the recipients' side. Panel data analysis highlights which country characteristics ensure that some recipients are more successful than others in attracting mitigation finance. Chapter 4 brings mitigation finance supply and demand together by pairing donor and recipient data on mitigation finance, for instance testing whether the ex-colonial status of developing countries influences the amount of mitigation finance they receive from their ex-colonial ruler.

APPENDIX 2.1: LIST OF VARIABLES AND DATA SOURCES

Type of Variable	Variable label	Definition	Data Source
Mitigation finance	sharemfodacommit sharemfodadisburse	Proportion of mitigation in total ODA commitment disbursement	OECD (2009a, 2009b)
	lnmfcommit lnmfdisburse	Log of the amount of mitigation finance commitment disbursement in constant US$ 2009 prices (mitigation marker is coded as principal and significant)	OECD (2009a)
	mfdcratio	The amount of mitigation finance disbursement divided by the amount of mitigation finance commitment in constant US$ 2009 prices	Author's calculation using the data from OECD (2009b)
	lnmixedcf	Log of the amount of mixed mitigation finance in constant US$ 2009 (i.e. mitigation finance provided for activities that exclusively focus on climate change mitigation and adaptation, as well as for activities that relate both to climate change as well as biodiversity and desertification (i.e. categories 1, 4, 5 and 6 of the Rio Marker)	OECD (2009b)
Carbon emissions	lnghgpc	Log of the total six types of emissions listed below in thousand metric tons of carbon divided by total population	Author's calculation using the data from Boden *et al.* (2011)
	lnco2pc	Log of carbon dioxide (CO_2) in thousand metric tons of carbon divided by total population	Boden *et al.* (2011)
	lnch4pc	Log of methane (CH_4) in thousand metric tons of CO_2 equivalent divided by total population	UNFCCC (2013)
	lnpfcspc	Log of perfluorocarbons (PFCs) in thousand metric tons of CO_2 equivalent divided by total population	
	lnhfcspc	Log of hydrofluorocarbons (HFCs) in thousand metric tons of CO_2 equivalent divided by total population	
	lnsf6pc	Log of sulphur hexafluoride (SF_6) in thousand metric tons of CO_2 equivalent divided by total population	
	lnn2opc	Log of nitrous oxide (N_2O) in thousand metric tons of c CO_2 equivalent divided by total population	
	co2inten	CO_2 intensity (kg per kg of oil equivalent energy use)	WDI (2011)

	altenergy	Alternative and nuclear energy (% of total energy use)	(*ibid*)
Level of wealth	lngdppc	Log of Gross Domestic Product (GDP) per capita in constant US$ 2009	(*ibid*)
Institutional measures	govern	The average of six Kaufmann's World Governance Indicators (listed below). Each indicator ranges from -2.5 to 2.5 (max)	Author's calculation based on (Kaufmann *et al.*, 2010)
	regulquality	*Regulatory quality* captures the ability of government to formulate and implement sound policies and regulations	Kaufmann *et al.* (2010)
	ruleoflaw	R*ule of law* index captures the extent to which agents have confidence in and abide by the rules of society, as well as the quality of contract enforcement and property rights	(*ibid*)
	voiceaccount	*Voice and accountability* captures the extent to which citizens can participate in government selection procedures and have freedom of expression and association	(*ibid*)
	contcorrupt	C*ontrol of corruption* captures the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests	(*ibid*)
	polstability	*Political stability* captures perceptions on the likelihood that governments become destabilised or overthrown by unconstitutional or violent means	(*ibid*)
	goveffective	*Government effectiveness* that captures the quality of public services and policy formulation, as well as the degree of government commitment to policies.	(*ibid*)
Environmental expenditure	environexpen	Proportion of environmental expenditure in national budget	IMF (2009)
Kyoto protocol ratification	kyotoprot	Kyoto protocol ratification; coded 1 if ratified; coded 0 otherwise	CIESIN-SEDAC (2011)
Composition of donor government	leftgov	Coded: (1) conservative, Christian democratic, or right-wing; (2) centrist and (3) communist, socialist, social democratic, or left-wing	Keefer (2010)
Level of democracy	democracy	0 to 10 index, where higher values correspond to more democratic states	Marshall *et al.* (2011)
Total ODA	lnodacommit lnodadisburse	Log of total ODA commitment disbursement in constant US$ 2009	OECD (2009c)
Population	lnpop	Log of population size	WDI (2011)

APPENDIX 2.2: DESCRIPTIVE STATISTICS

Variable label	No of observations	Mean	Standard Deviation	Min	Max
sharemfodacommit	199	0.022	0.035	0.000	0.267
sharemfodadisburse	142	0.016	0.025	0.000	0.143
sharetotcfodacommit	215	0.037	0.047	0.000	0.292
lnmfcommit	199	2.585	2.594	-5.409	8.290
lnmfdisburse	142	2.429	2.234	-3.285	7.655
lnodacommit	264	7.472	1.315	4.667	10.371
lnodadisburse	176	7.535	1.301	5.013	10.272
mfdcratio	137	4.667	19.993	0.023	190.649
lntotalmf	215	3.328	2.218	-4.280	8.376
lnghgpc	241	-4.526	0.4825	-5.961	-3.260
lnco2pc	264	2.229	0.336	1.548	3.008
lnch4pc	241	-6.766	0.834	-8.717	-4.926
lnhfcspc	241	-9.040	0.545	-11.041	-7.428
lnpfcspc	240	-11.271	2.169	-19.684	-8.001
lnsf6pc	241	-11.095	1.187	-14.398	-8.234
lnn2opc	241	-7.013	0.572	-8.639	-5.912
co2inten	264	2.238	0.548	0.960	3.427
altenergy	264	16.815	14.247	0.554	50.734
lngdppc	264	10.393	0.205	9.743	10.933
enviroexpen	172	0.512	0.330	-0.458	1.617
kyotoprot	264	0.417	0.494	0.000	1.000
leftgov	251	1.956	0.935	1.000	3.000
democracy	264	9.841	0.498	8.000	10.000
lnpop	264	16.776	1.212	15.127	19.542
govern	210	1.398	0.360	0.502	1.913
regulquality	210	1.402	0.317	0.537	2.012
ruleoflaw	220	1.503	0.379	0.313	1.964
voiceaccount	220	1.345	0.254	0.609	1.827
contcorrupt	220	1.634	0.587	0.156	2.466
polstability	220	0.927	0.371	-0.180	1.577
goveffective	220	1.592	0.426	0.316	2.237

APPENDIX 2.3: CORRELATION MATRIX

	sharemfoda	sharemfdisburse	totmfodashare	lnmfcommit	lnmfdisburse	mfdcratio	lntotalmf
mfdisburse	0.7477*	1.0000					
	0.0000						
totmfodashare	0.8975*	0.6717*	1.0000				
	0.0000	0.0000					
lnmfcommit	0.7025*	0.5251*	0.6801*	1.0000			
	0.0000	0.0000	0.0000				
lnmfdisburse	0.6914*	0.7002*	0.6485*	0.8700*	1.0000		
	0.0000	0.0000	0.0000	0.0000			
mfdcratio	-0.1308	0.0487	-0.1507	-0.3745*	-0.0480	1.0000	
	0.1276	0.5720	0.0789	0.0000	0.5774		
lntotalmf	0.6964*	0.5043*	0.7502*	0.9159*	0.8266*	-0.2809*	1.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	
lnodacommit	0.3881*	0.2436*	0.3039*	0.6692*	0.6652*	-0.1747	0.6571*
	0.0000	0.0035	0.0000	0.0000	0.0000	0.0412	0.0000
lnodadisburse	0.3864*	0.2362*	0.3087*	0.6753*	0.6604*	-0.1794	0.6490*
	0.0000	0.0047	0.0001	0.0000	0.0000	0.0359	0.0000
lnghgpc	-0.0608	-0.2089	-0.0240	-0.0083	-0.0991	-0.0354	0.0196
	0.4061	0.0162	0.7332	0.9094	0.2582	0.6932	0.7810
lnco2pc	-0.0186	-0.1387	0.0498	0.0835	0.0299	-0.0127	0.1384
	0.7939	0.0997	0.4672	0.2412	0.7239	0.8833	0.0427
lnch4pc	-0.4124*	-0.3941*	-0.3566*	-0.3553*	-0.4274*	0.0155	-0.3654*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.8625	0.0000
lnhfcspc	-0.0084	-0.0840	-0.0053	0.1226	0.0783	-0.0888	0.1697
	0.9083	0.3382	0.9397	0.0928	0.3722	0.3206	0.0152
lnpfcspc	0.0344	-0.0501	-0.0018	0.2924*	0.2236	-0.3431*	0.2684*
	0.6397	0.5696	0.9802	0.0000	0.0103	0.0001	0.0001
lnsf6pc	0.1190	0.0010	0.1002	0.3985*	0.3785*	-0.2383*	0.3323*
	0.1030	0.9906	0.1538	0.0000	0.0000	0.0070	0.0000
lnn2opc	-0.4245*	-0.4321*	-0.3138*	-0.3126*	-0.4012*	0.0028	-0.3286*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.9752	0.0000
carboninten	0.0661	-0.0308	0.0394	-0.0705	-0.1604	0.0073	-0.0864
	0.3535	0.7162	0.5656	0.3221	0.0566	0.9328	0.2068
altenergy	-0.0174	0.0792	-0.0730	0.1080	0.1823	-0.0989	0.0683
	0.8077	0.3488	0.2865	0.1291	0.0299	0.2502	0.3185
lngdppc	0.0341	0.0437	0.0695	0.3340*	0.3814*	-0.1886	0.3028*
	0.6328	0.6057	0.3103	0.0000	0.0000	0.0273	0.0000
enviroexpen	-0.1377	-0.0136	-0.0633	0.0135	0.1090	0.0748	-0.1249
	0.1153	0.8956	0.4479	0.8782	0.2929	0.4808	0.1330
kyotoprot	0.1521	0.2444*	0.1811*	0.1629	0.2870*	-0.0310	0.2325*
	0.0320	0.0034	0.0078	0.0215	0.0005	0.7193	0.0006
leftgov	-0.1502	-0.0335	-0.1406	-0.1471	-0.1325	0.1019	-0.1591
	0.0401	0.6993	0.0455	0.0445	0.1254	0.2485	0.0234
democracy	-0.0159	-0.0390	-0.0384	-0.0981	-0.0715	0.0647	-0.1077
	0.8238	0.6453	0.5753	0.1680	0.3981	0.4524	0.1155
lnpop	0.2861*	0.1710	0.1695	0.4226*	0.4228*	-0.1136	0.4192*
	0.0000	0.0419	0.0128	0.0000	0.0000	0.1864	0.0000
govern	-0.0820	-0.1578	0.0136	0.0341	0.0007	0.0464	0.0256
	0.2837	0.0607	0.8563	0.6558	0.9934	0.5902	0.7342
regulquality	-0.1416	-0.2270*	-0.0465	-0.0153	-0.0497	0.0655	0.0008
	0.0631	0.0066	0.5367	0.8415	0.5572	0.4473	0.9919
ruleoflaw	-0.0093	-0.0755	0.0562	0.1361	0.1181	-0.0185	0.1002
	0.9036	0.3718	0.4458	0.0742	0.1616	0.8300	0.1735
voiceaccount	-0.1640	-0.1998	-0.0773	-0.0638	-0.0924	0.0728	-0.0528
	0.0311	0.0171	0.2943	0.4041	0.2739	0.3980	0.4745
contcorrupt	-0.0521	-0.1188	0.0521	0.0745	0.0634	0.0385	0.0733
	0.4961	0.1592	0.4804	0.3300	0.4537	0.6552	0.3201
polstability	-0.0159	-0.1049	0.0391	-0.0702	-0.1130	0.1034	-0.0919
	0.8354	0.2142	0.5964	0.3584	0.1807	0.2291	0.2122
goveffective	-0.1120	-0.1762	-0.0194	0.0519	-0.0042	0.0155	0.0319
	0.1424	0.0359	0.7923	0.4976	0.9601	0.8574	0.6657

	lnodacommit	lnodadisburse	lnghgpc	lnco2pc	lnch4pc	lnhfcspc	lnpfcspc
lnodadisburse	0.9896*	1.0000					
	0.0000						
lnghgpc	0.1072	0.1024	1.0000				
	0.0967	0.1974					
lnco2pc	0.2364*	0.2178*	0.8489*	1.0000			
	0.0001	0.0037	0.0000				
lnch4pc	-0.3776*	-0.3803*	0.5920*	0.4878*	1.0000		
	0.0000	0.0000	0.0000	0.0000			
lnhfcspc	0.4663*	0.3686*	0.3837*	0.4135*	0.1610	1.0000	
	0.0000	0.0000	0.0000	0.0000	0.0123		
lnpfcspc	0.3410*	0.3445*	0.2588*	0.3844*	0.1169	0.2325*	1.0000
	0.0000	0.0000	0.0000	0.0000	0.0707	0.0003	
lnsf6pc	0.4754*	0.5393*	0.2230*	0.3675*	-0.1574	0.2156*	0.6795*
	0.0000	0.0000	0.0005	0.0000	0.0144	0.0008	0.0000
lnn2opc	-0.3826*	-0.3834*	0.4547*	0.3910*	0.8533*	0.1363	0.2059*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0344	0.0013
carboninten	-0.1651*	-0.1317	0.6713*	0.4261*	0.3272*	0.1221	-0.0929
	0.0072	0.0815	0.0000	0.0000	0.0000	0.0584	0.1513
altenergy	0.1699*	0.1527	-0.5932*	-0.4255*	-0.2431*	-0.0949	0.2299*
	0.0057	0.0430	0.0000	0.0000	0.0001	0.1417	0.0003
lngdppc	0.5054*	0.4753*	0.0767	0.2395*	-0.0156	0.3141*	0.4672*
	0.0000	0.0000	0.2356	0.0001	0.8101	0.0000	0.0000
enviroexpen	-0.1438	-0.0775	0.3094*	0.2271*	0.3804*	0.0283	-0.0283
	0.0598	0.4104	0.0001	0.0027	0.0000	0.7218	0.7220
kyotoprot	0.1705*	0.1027	-0.0868	-0.0469	-0.0744	0.3434*	-0.0945
	0.0055	0.1750	0.1795	0.4482	0.2499	0.0000	0.1444
leftgov	-0.1674*	-0.1903	-0.1069	-0.1091	0.1571	-0.0573	-0.1628
	0.0079	0.0137	0.1065	0.0844	0.0174	0.3878	0.0139
democracy	0.0759	0.1220	0.0603	0.0917	0.0915	-0.1287	-0.0717
	0.2188	0.1067	0.3511	0.1373	0.1567	0.0460	0.2682
lnpop	0.7114*	0.7075*	0.2403*	0.2812*	-0.2398*	0.3961*	0.1538
	0.0000	0.0000	0.0002	0.0000	0.0002	0.0000	0.0171
govern	0.0628	0.0692	0.0600	0.1213	0.3070*	0.0498	0.0846
	0.3653	0.3726	0.4106	0.0794	0.0000	0.4946	0.2469
regulquality	0.0918	0.1086	0.2631*	0.2280*	0.4467*	0.3188*	0.0110
	0.1852	0.1611	0.0002	0.0009	0.0000	0.0000	0.8805
ruleoflaw	0.1346	0.1410	0.0659	0.1576	0.2597*	0.1484	0.1441
	0.0462	0.0619	0.3541	0.0193	0.0002	0.0360	0.0422
voiceaccount	-0.0242	0.0140	-0.0106	0.0315	0.3421*	-0.0371	-0.0321
	0.7208	0.8537	0.8816	0.6417	0.0000	0.6017	0.6525
contcorrupt	0.1026	0.1307	0.0405	0.1108	0.2751*	0.0928	0.0524
	0.1294	0.0838	0.5692	0.1013	0.0001	0.1911	0.4623
polstability	-0.2128*	-0.2554*	-0.1223	-0.0379	0.0810	-0.4070*	0.0197
	0.0015	0.0006	0.0844	0.5761	0.2539	0.0000	0.7829
goveffective	0.1353	0.1334	0.0937	0.1689	0.2204*	0.1343	0.1891*
	0.0451	0.0775	0.1870	0.0121	0.0017	0.0579	0.0075

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	lnsf6pc	lnn2opc	co2inten	altenergy	lngdppc	enviroexpen	kyotoprot
lnn2opc	-0.0699	1.0000					
	0.2796						
co2inten	-0.1070	0.0803	1.0000				
	0.0976	0.2140					
altenergy	0.2010*	-0.0743	-0.8938*	1.0000			
	0.0017	0.2503	0.0000				
lngdppc	0.5024*	0.0398	-0.2598*	0.2427*	1.0000		
	0.0000	0.5390	0.0000	0.0001			
enviroexpen	-0.0174	0.3340*	0.2854*	-0.3874*	0.1609	1.0000	
	0.8267	0.0000	0.0001	0.0000	0.0350		
kyotoprot	-0.1524	-0.1236	-0.0500	0.0048	0.2872*	0.0825	1.0000
	0.0179	0.0554	0.4187	0.9385	0.0000	0.2822	
leftgov	-0.0884	0.1741*	-0.0563	0.0341	-0.1980*	0.0441	-0.1512
	0.1823	0.0083	0.3745	0.5903	0.0016	0.5664	0.0165
democracy	-0.0373	0.0021	0.1489	-0.1924*	0.3512*	0.2175*	-0.0541
	0.5645	0.9747	0.0154	0.0017	0.0000	0.0042	0.3816
lnpop	0.3221*	-0.3849*	0.1840*	-0.1055	-0.0584	-0.2904*	0.0168
	0.0000	0.0000	0.0027	0.0872	0.3448	0.0001	0.7861
govern	0.1558	0.4754*	-0.4226*	0.2682*	0.4990*	0.2688*	-0.1022
	0.0318	0.0000	0.0000	0.0001	0.0000	0.0017	0.1400
regulquality	0.0437	0.5204*	-0.2205*	0.0326	0.4284*	0.4252*	0.0114
	0.5490	0.0000	0.0013	0.6380	0.0000	0.0000	0.8690
ruleoflaw	0.2840*	0.3789*	-0.3935*	0.2956*	0.5465*	0.2349*	-0.0111
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0047	0.8701
voiceaccount	-0.0625	0.4967*	-0.3542*	0.2050*	0.4718*	0.1548	-0.0595
	0.3790	0.0000	0.0000	0.0022	0.0000	0.0649	0.3800
contcorrupt	0.1579	0.4144*	-0.3968*	0.2562*	0.4773*	0.1971	-0.0708
	0.0256	0.0000	0.0000	0.0001	0.0000	0.0183	0.2958
polstability	0.0389	0.1953*	-0.3079*	0.1977*	0.2587*	0.2028	-0.2191*
	0.5840	0.0056	0.0000	0.0032	0.0001	0.0151	0.0011
goveffective	0.2358*	0.4182*	-0.4180*	0.3115*	0.4932*	0.1651	-0.1647
	0.0008	0.0000	0.0000	0.0000	0.0000	0.0488	0.0144

	leftgov	democracy	lnpop	govern	regulquality	ruleoflaw
democracy	0.0883	1.0000				
	0.1631					
lnpop	-0.1029	-0.2029*	1.0000			
	0.1039	0.0009				
govern	0.1183	0.4331*	-0.4915*	1.0000		
	0.0960	0.0000	0.0000			
regulquality	0.1475	0.3858*	-0.3225*	0.8839*	1.0000	
	0.0377	0.0000	0.0000	0.0000		
ruleoflaw	0.0822	0.3462*	-0.4031*	0.9540*	0.8404*	1.0000
	0.2367	0.0000	0.0000	0.0000	0.0000	
voiceaccount	0.1270	0.5014*	-0.5439*	0.8908*	0.7771*	0.7863*
	0.0670	0.0000	0.0000	0.0000	0.0000	0.0000
contcorrupt	0.1551	0.4332*	-0.4151*	0.9780*	0.8747*	0.9355*
	0.0249	0.0000	0.0000	0.0000	0.0000	0.0000
polstability	0.1092	0.4248*	-0.6127*	0.7626*	0.4943*	0.6564*
	0.1155	0.0000	0.0000	0.0000	0.0000	0.0000
goveffective	0.0245	0.3001*	-0.3764*	0.9404*	0.8207*	0.8960*
	0.7249	0.0000	0.0000	0.0000	0.0000	0.0000

	voiceaccount	contcorrupt	polstability	goveffective
contcorrupt	0.8577*	1.0000		
	0.0000			
polstability	0.6537*	0.6665*	1.0000	
	0.0000	0.0000		
goveffective	0.7952*	0.8972*	0.6335*	1.0000
	0.0000	0.0000	0.0000	

3. CLIMATE MITIGATION FINANCE ACROSS DEVELOPING COUNTRIES: WHAT ARE THE MAJOR DETERMINANTS?*

Abstract

This chapter assesses the relationship between the characteristics of developing countries and the amount of official climate mitigation finance inflow. A two-part model and robustness checks were used to analyse 1998-2010 Rio Marker data on 180 developing countries. The results show that developing countries with higher CO_2 intensity per unit of GDP, larger carbon sinks, lower per capita GDP and good governance tend to be selected as recipients of climate mitigation finance, and to receive more of it. CO_2 emissions are not used as a determinant of mitigation finance until the actual financial disbursement. Poverty aid tends to be allocated to countries with low CO_2 emissions, possibly to avoid diverting aid from poorer developing countries. However, such a diversion is unavoidable if the share of mitigation finance in climate finance and in overall ODA continues to escalate. This study calls for an equitable allocation of official mitigation and adaption finance, and for transparent criteria and the verification of reporting on the allocation of mitigation finance. Additionally, the chapter examines (1) the influence of developing countries' commitment to international climate-related conventions on their eligibility as mitigation finance recipients, (2) the variability of significant determinants of mitigation finance inflows across different phases of the Kyoto Protocol periods. The research finds that developing countries' commitment to the Kyoto Protocol is a significant determinant of its eligibility for receiving mitigation finance. Even before the adoption of the Kyoto Protocol, the CO_2 emissions variable has been used as a negative parameter of overall aid and has been adopted in mitigation finance disbursement since the Kyoto Protocol came into force.

Keywords: Climate Mitigation Finance, Developing Countries, ODA

3.1. Introduction

ODA is increasingly devoted to funding climate change mitigation in developing countries (hereafter 'mitigation finance') (Bierbaum & Fay, 2010;

* Part of this chapter has been published as a working paper Halimanjaya (2013) and is forthcoming in Climate Policy.

OECD, 2011a). Official finance devoted to tackle climate problems comprises mainly mitigation rather than adaptation finance (Halimanjaya & Papyrakis, 2012). In the past decade the relatively small amount of mitigation finance increased[1] rapidly while that of poverty aid increased at a slower rate (Figure 1.5). Little is known about official mitigation finance specificities, although there are some studies examining the allocation of private mitigation finance and global adaptation finance (Dolšak & Crandall, 2013; Michaelowa & Michaelowa, 2011a).

The amount of ODA allocated to fund mitigation has continued to escalate rapidly, although definitions of and principal guidance on climate finance, i.e. how much of ODA can be used as climate finance and mitigation finance in particular, are not yet agreed. Thus whether mitigation finance can be considered as 'aid' is not clearly determined. The extent to which it should focus on reducing emissions and prioritising global as opposed to local development is also unclear. On the top of these issues, developed and developing countries have not yet agreed on the indicative list and definition of the 'full incremental costs' of climate action stated in the UNFCCC (1992), Article 4.3; that is, the additional costs of developing countries' emission reduction activities that are financed by developed countries (Olbrisch *et al*., 2011).

With this lack of definitive parameters with which to allocate mitigation finance, the OECD's (2011) promotion of the use of ODA as fast-start climate finance and for prescriptive climate research (Eliasch, 2008; Stern,

[1] The increasing number of donor countries implementing the Rio Marker aid reporting system, as shown in Chapter 2, partly explains this increasing trend in mitigation finance. Figure 2.2 shows that the number of DAC donors reporting their provision of mitigation finance from 2006 onwards is higher than that before 2006, a finding that agrees with the project-level data used in this paper. The number of reported projects recorded by OECD in Creditor Reporting System (CRS) in 2006 is ten times that of 2003 (see Table 1.2).

2008) is improving the fungibility of ODA. This allows donors greater flexibility in how they spend it to fund mitigation activities while also aiming to alleviate poverty in line with the original aim of ODA.

This will accelerate the mainstreaming of climate change into the development agenda (Klein *et al*., 2005) at the risk of diverting ODA from its fundamental objective of halving world poverty (Michaelowa & Michaelowa, 2007). ODA may support projects that aim to create an enabling environment for developing countries to later host Clean Development Mechanism (CDM) projects (Dutschke & Michaelowa, 2006). The strong emphasis on 'additionality' as a conceptual safeguard aims to ensure an equitable financial distribution between richer and poorer developing countries and to ensure that climate finance remains additional to ODA rather than diverting funds from its poverty agenda. Nevertheless the definition of additionality is debatable, as the actual status of climate finance as additional remains unclear (Ballesteros *et al.*, 2010; Stadelmann *et al*., 2010).

The absence of definitive parameters for official mitigation finance calls for the identification of its determinants by the academic community. Little research has been devoted to identifying the determinants used in the allocation and disbursement of official mitigation finance. There is a lack of information, for example, on how allocation is influenced by countries' positions in the UNFCCC negotiations, and such as the extent to which certain developing countries' characteristics (e.g. country size) determine the financial inflows they receive. The study conducted by Yohe (2001, pp. 103–104) initiates an early discussion about the allocation criteria of mitigation finance. He proposes several variables for consideration under the mitigative capacity framework, namely technological options, policy instruments, institutional structure, resource distribution channels, and human and social capital. However, little information is available about how these variables affect the global allocation of official mitigation finance in the period since this study.

The next section reviews relevant literature on mitigation finance, climate finance, environmental aid allocation and aid more broadly. Section 3 shows an overview of global mitigation finance. Sections 4 and 5 explain the hypotheses and the research methods. Section 6 analyses the determinants of mitigation finance; section 7 compares determinants of mitigation finance, poverty aid and overall ODA; section 8 examines the influence of developing countries' commitment to international climate conventions on their eligibility for mitigation finance; section 9 assesses the variability of significant determinants affecting mitigation finance allocation in different Kyoto Protocol periods, and section 10 summarises the findings and presents the concluding remarks. While not all of the results are reported in the text, they are included in the appendices.

3.2. Literature review

To the author's knowledge only a few studies clarify the relationships between these variables representing developing countries' characteristics and the distribution of climate finance. These studies focus on streams other than official mitigation finance, such as adaptation finance (Michaelowa & Michaelowa, 2011b; Stadelmann *et al.*, 2013) and private mitigation finance (Dolšak & Crandall, 2013; Winkelman & Moore, 2011).

Evidence from the study of private mitigation finance shows that much private investment is influenced by political factors such as colonial ties, which are a strong determinant of CDM host location (Dolšak & Crandall, 2013). This evidence is in line with Hicks *et al.*'s (2008) finding from their broader study of environmental aid. Their finding also supports earlier and and more recent studies that show economic performance determines decisions about environmental aid and green investment (Eyraud *et al.*, 2011; Lewis, 2003). Little research has compared environmental aid with more traditional poverty aid. Lewis (2003) briefly discusses the difference between the two but does not provide supporting evidence.

Maizels and Nissanke's (1984) early study of overall aid finds that when a donor has the freedom to pledge an amount of aid to a particular country or countries, this amount is contingent upon the extent to which its beneficiaries are able to facilitate the donor's political, security and trade interests. Alesina and Dollar (2000) argue that recipients' development needs and governance, which Hoeffler and Outram (2011) frame as recipients' performance, balance these factors.

So far academic studies are limited to informing the parameters of official mitigation finance allocation. The chapter responds to this academic limitation and supports climate and development community in its policy formulation of setting definitive and transparent parameters of the allocation of official mitigation finance across developing countries by identifying and comparing them with the determinants of poverty aid.

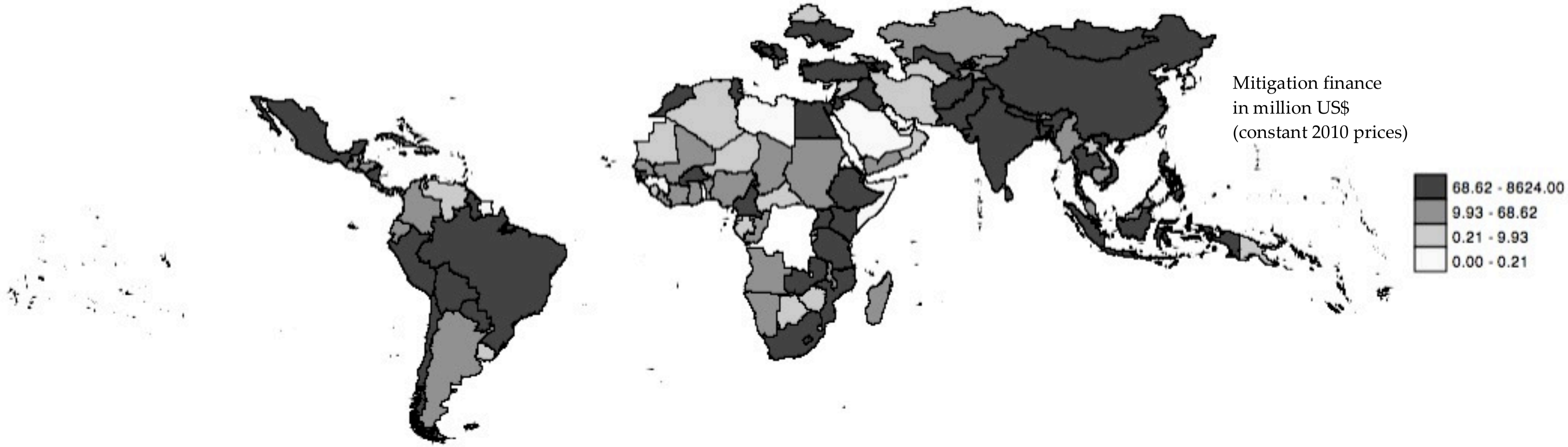
The latter is motivated by two factors. First, using mitigation finance sourced from ODA to invest in global public goods (Brown *et al.*, 2010) is controversial; it may be allocated to specific countries to treat emission problems caused by other countries. Secondly, the major sources of GHG emissions are mainly large industries, namely cement, fertilizer and refrigerant manufacturers (Grubb, 2003, p. 147). Hence to reduce emissions on a large scale, mitigation finance is rationally allocated to industrialised developing countries, shifting aid away from poor regions.

This chapter evaluates the extent to which donors' decisions to finance climate mitigation activities in developing countries are influenced by the latter's environmental, economic and institutional capacity and capability and other characteristics. It assesses primarily bilateral DAC donors' total contributions to supporting developing countries to finance mitigation projects. Being the first empirical study to identify the determinants of the allocation of official mitigation finance and covering a vast coverage of 180 developing countries and countries with economies in transition, this chapter tests new variables: total and individual GHG and change in CO_2 intensity per unit of GDP. It adds value to general aid studies by comparing the determinants of poverty aid and mitigation finance. This chapter neither evaluates which sets of criteria are most cost-effective nor proposes a set of allocation criteria, both of which are beyond its scope; its aim is solely to identify the determinants of mitigation finance and to compare them with the determinants of poverty aid. To additionally contribute to the study of development aid more broadly, some comparisons between mitigation finance or and poverty aid and or overall ODA are made whereever it is relevant.

3.3. The global overview of mitigation finance

Figure 3.1 shows mitigation finance commitment (1998-2010) distributed across 148 of 180 countries studied in this chapter. This amount of mitigation finance commitment in this chapter is total contribution of all DAC donors (see both lists of developing countries and donors in Appendix 3.1).

Figure 3.1: The concentration of mitigation finance across developing countries



All figures in this chapter are by the author using data from OECD (2012a) unless otherwise indicated. Russia is not part of the DAC system and some Eastern European countries are not illustrated on the map. See Appendix 3.1 for a complete list of the countries included in this chapter's analysis.

The figure shows that mitigation finance is concentrated in a small number of developing countries. Herhindahl index indicates the level of concentration of funding measured by the sum of squared share of all developing countries (a higher score indicates a higher concentration). The index of mitigation finance shown in Appendix 3.1 is relatively high if it is compared to the index of the ODA more generally. The index of mitigation finance is (0.105), which is almost five times than the Herfindahl Index of overall ODA (0.020) indicating fewer recipient countries receive the majority of mitigation finance.

Mitigation finance is also concentrated in specific sectors. Table 3.1 shows that the sectors prioritised in mitigation finance are primarily energy (36%) and transport and storage (26%). Table 3.1 also shows what consistutes as poverty aid. In this chapter poverty aid is defined as the remainder of ODA, which does not contribute to principal and significant climate change mitigation or adaptation objectives but includes unmarked projects.

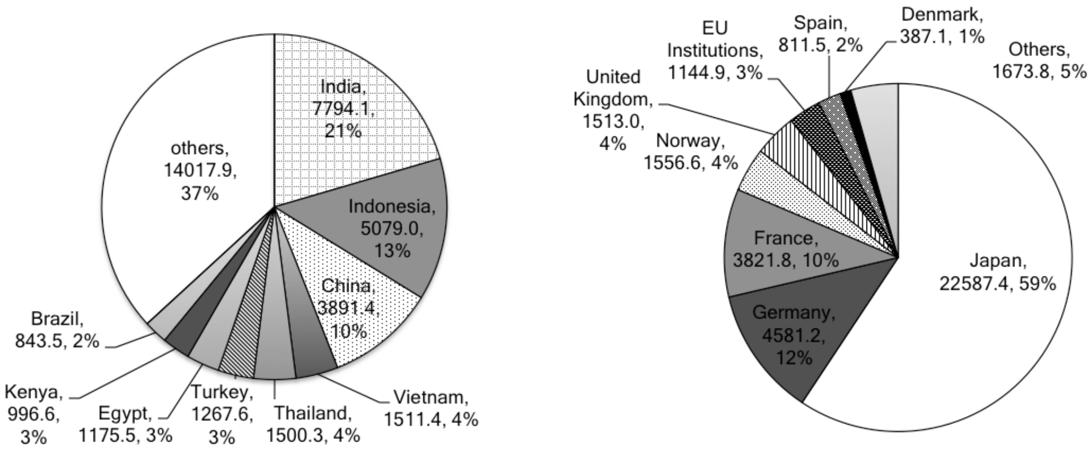
Table 3.1: Classification of official mitigation finance, 1998-2010

Category	Total amount of commitment in billion US$ 2010 prices				
Official mitigation finance*			41.7		
Energy	15.0	36%			
Transport and storage	10.7	26%			
General environment protection	9.0	21%			
Forestry	3.1	7%			
Water supply and sanitation	1.6	4%			
Other sectors	2.3	4%			
Other official climate finance, including adaptation			29.9		
Official climate finance**				71.6	
Official poverty aid***				1238.7	
Total ODA					1310.3

*Projects with mitigation as the principal objective. ** Projects with mitigation and adaptation as a principal or significant objectives ***As defined above.

Over half of all mitigation finance goes to India, Indonesia, China, Vietnam and Thailand, and its provision is mainly reliant on Japan, Germany, and France (Figure 3.2). Bosetti *et al.* (2009) argue that early emission mitigation in richer developing countries is economically attractive and possibly cheaper on a large scale. Figure 3.3 shows that Europe irregularly receives a large proportion of ODA mitigation finance, while South Asia with low CO_2 per capita receives almost a third of poverty aid. Some small states such as Mauritius and Guyana receive over 30% of ODA as mitigation finance, although their share in total global mitigation finance is relatively small (Figure 3.4).

Figure 3.2: Major mitigation finance recipients (left) and donors (right)



Note*:* Nominal figures are accumulated mitigation finance commitment (1998-2010) (OECD, 2012a)

Figure 3.3: Total mitigation finance, poverty aid and average of CO_2 per capita across regions, 1998-2010

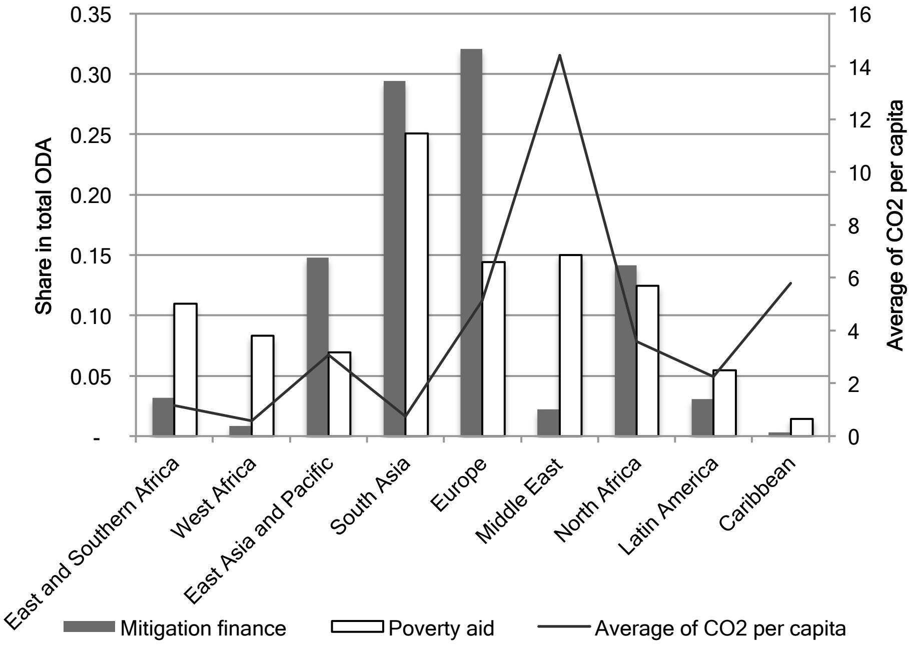
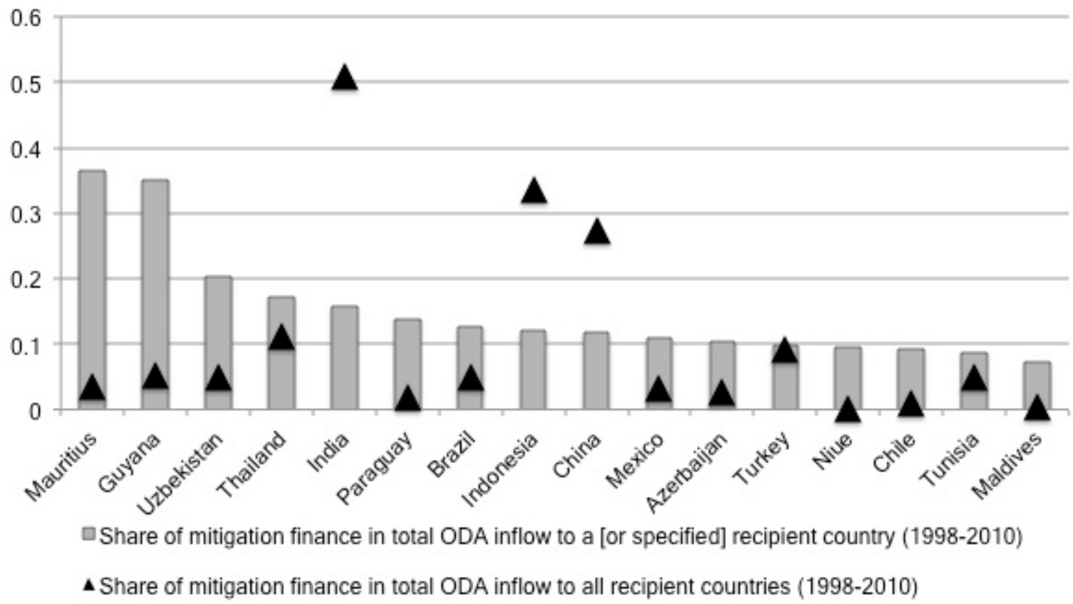


Figure 3.4: Proportion of mitigation finance in recipients' and total ODA



A profound difference in the distribution of mitigation finance and that of poverty aid emerges in their distribution across income groups (Table 3.2).

Least-developed and low-income countries with relatively low CO_2 emissions receive only 17.2% of total mitigation finance, but they are still the dominant poverty aid recipients (51.9%) and overall ODA (50.7%).

Table 3.2: Accumulated mitigation finance, poverty aid and overall ODA across income groups, 1998-2010

OECD's country classification based on income	Mitigation finance in billion US$ 2010 prices	% of total mitigation finance	Climate finance in billion US$ 2010 prices	% of total mitigation finance	Overall ODA in billion US$ 2010 prices	% of total Overall ODA	Poverty aid in billion US$ 2010 prices	% of total poverty aid
	(1)		(2)		(3)		(3) - (2)	
Least developed countries	2.7	6.4	9.2	12.9	461.1	35.2	451.8	36.1
Other low income countries	3.7	8.8	6.7	9.3	203.6	15.5	197.0	15.8
Lower middle income countries	26.6	64.0	38.5	53.8	527.6	40.3	489.1	39.1
Upper middle income countries	3.8	9.0	5.8	8.2	113.8	8.7	107.9	8.6
More advanced developing countries	0.0	0.0	0.0	0.0	4.3	0.3	4.2	0.3
Unallocated by income	4.9	11.9	11.3	15.7			(11.3)*	
Total	41.7	100	71.6	100	1310.3	100	1238.7	100

* The amount of mitigation finance reported to the OECD CRS that is not allocated by country hence it cannot be categorised into income level. These projects are excluded in the econometric analysis of this paper since there is no information to which country the associated amount is allocated. Some projects are not allocated by country since possibly they have global impact benefiting all countries or if they are allocated to regional projects benefiting several countries.

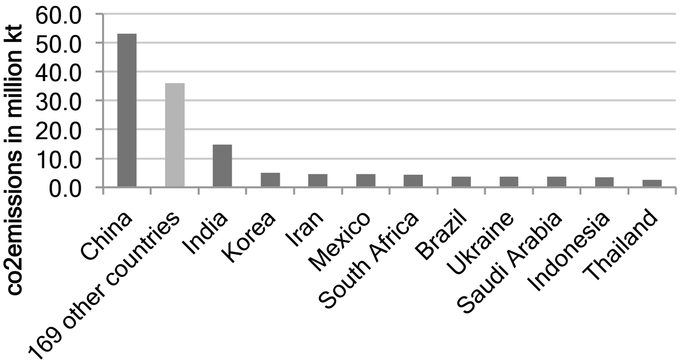
The descriptive statistics in this chapter have provided a global overview of mitigation finance, but so far they do not explain how the characteristics of developing countries, i.e. income level or region, may influence the amount of mitigation finance they receive. The next section explains the methods and econometric techniques in use to study such relationships.

3.4. Hypotheses

According to Stern (2008, p. 8), two thirds of emissions originate in energy consumption. The remainder is from waste (3%), agriculture (14%) and land-use change (18%), primarily deforestation. Assuming that developed countries already operate using energy-efficient technologies, some scholars suggest cheap options for improving energy efficiency in developing countries, such as by replacing old technologies with energy efficient ones (Berkeley *et al*., 1998: 395). Often large developing countries with large emissions (Figure 3.5) argue that they have insufficient technical knowledge for this (den Elzen & Höhne, 2008).

Hypothesis 1A: The larger the emissions of a developing country, the more likely it is to be selected as a recipient of mitigation finance and to receive more mitigation finance.

Figure 3.5. Accumulated CO_2 emissions (1998-2008)



The figure is by the author using data from WDI (2013)

The log of CO_2 emissions (WDI 2013), labelled *lnco2,* is used to measure the magnitude of emissions. Another five GHGs (UNFCCC, 2012) are tested separately, and this study also tests a mixed GHG (CO_2, CH_4, N_2O in CO_2 equivalent (CO_2e)) The three gases are selected as they have greater numbers of observations than the others. The trend of CO_2 intensity,

(CO_2/GDP), in two subsequent periods or in this study labelled as '*rci*' is measured by CO_2 intensity per unit of GDP of a developing country in the period of (t) divided by its CO_2 intensity per unit of GDP in the previous period (*t-1*), as in Eq. (2):

$$rci = \frac{CO2/GDP_t}{CO2/GDP_{t-1}} \tag{2}$$

rci>1 indicates increasing emissions produced per unit of economic activity since the previous period; *rci*<1 indicates otherwise (a decrease). *rci* in this study is different from the Responsibility and Capacity Index (RCI) introduced by Baer *et al.* (2010, p. 224), as the specification in this chapter does not allocate any weight to variable that are tested. Instead, it separately tests developing countries' emissions and natural capacity (carbon sinks). Ideally, *rci* is added to Eq. (1) and GHG in CO_2e replaces *lnco2*. However, these approaches significantly reduce sample size (see a limited sample of *rci* in Table 3.2), hence *lnco2* is kept as the main proxy for emissions and *rci* is tested separately. *lnco2* is expected to be insignificant in the case of poverty aid or overall ODA.

Hypothesis 1B: The greater the increase of CO_2 intensity per unit of GDP in a developing country, the more likely it is to be selected as a recipient of mitigation finance and to receive more mitigation finance.

The third variable, carbon sink, represents natural capacity to accumulate carbon (EWI, 2013). Predominantly forests, oceans and soils have the capacity to store, accumulate or release carbon dioxide (IPCC, 2007, p. 820). Preserving forest in developing countries is a low-cost and effective method of reducing global emissions (Canadell & Raupach, 2008). It stores a large amount of carbon emissions and has the potential to mitigate atmospheric carbon emissions (Bosetti *et al.*, 2009; Sasaki & Yoshimoto, 2010). This study also includes deforestation rate, following Figaj's (2010) study. The following hypotheses represent developing countries' mitigation capacity:

Hypothesis 2A: The larger the carbon sink of a developing country the more likely it is to be selected as a recipient of mitigation finance and to receive more mitigation finance.

In this thesis, deforestation (*deforest*) is a rate of gain (positive) or loss (negative) in per cent of the remaining forest area each year within the given period. For example, if a developing country has 100 ha in 2000 and 95 ha in 2005, *deforest* is calculated as:

$$= \frac{\left(\frac{(95-100)}{100}\times 100\right)}{2005-2000} = -1\%$$

The following hypotheses represent developing countries' mitigation capacity:

Hypothesis 2B: The higher the deforestation rate of a developing country the more likely it is to be selected as a recipient of mitigation finance and to receive more mitigation finance.

One might argue that emission and deforestation variables may be endogenous. It is true that the normative objective of mitigation finance is to mitigate emissions through various means such as improving energy efficiency and combating deforestation. So far there is lack of academic literature showing that the deployment of mitigation finance has immediate results in developing countries such as decreasing emission and deforestation levels; at the global level, the most recent studies show that emission levels continue to increase with irreversible effects (IPCC, 2014). Hence it may be too early to assume that mitigation finance is effectively reducing emissions. Using this as the basis of an assumption on which to improve the model without sufficient scientific proof may lead to false inferences.

Marine Protected Areas[2] (MPAs) are considered an alternative to carbon sinks. Recent studies show that the marine sector also offers mitigation potential through 'blue carbon' reservoirs such as mangrove plantations, sea-grass beds and salt marshes. Mcleod *et al.* (2011) and Wickramasinghe *et al.* (2009) show that these reservoirs make a bigger contribution per unit area to long-term carbon sequestration than terrestrial forest. Mixed mitigation finance investment in MPAs often aims to protect biodiversity, with possible long-term reduction of carbon emissions. This study separately tests the percentage of MPAs in total territorial waters as an additional proxy for carbon sinks, labelled '*marine*'.

Due to much uncertainty about land tenure rights, idle sinks with potential for conversion are not tested in this study, although ideally they should be included. This study acknowledges Emerson *et al.*'s (2012) Environmental Performance Index (EPI), but this is not tested since most of mitigation aspects of EPI are already covered by variables in the hypotheses in this paper.

Governance is included based on the argument that aid is more effective in a good policy environment (Dollar & Levin, 2006; Epstein & Gang, 2009). Without good governance, developing countries may find it difficult to comply with expensive and administrative MRV system (Bierbaum & Fay,

[2] In 1998-2010, 60 of the 10,903 development projects primarily aimed at climate mitigation included the words 'marine', 'mangrove', 'fisheries', 'ocean', 'fishery' and 'reef' in their description. In this period a total of US$ 30 million was awarded to these projects. This may underestimate the overall amount of mitigation finance intended to enhance blue carbon. The project descriptions use acronyms that conceal the relevant words and broad terms, e.g. 'biodiversity projects'. Word search may not be a robust method of accurately identifying mitigation finance given to the projects to enhance blue carbon, hence it is difficult to identify and remove such projects from the dataset.

2010). The absence of proper land tenure rights such as in parts of Africa (Unruh, 2008) is a major obstacle to carbon sequestration projects. All six governance indicators (Kaufmann *et al.*, 2010) are individually tested, and all are statistically significant (Appendix 3.6).

Hypothesis 3: The better the governance of a developing country, the more likely it is to be selected as a recipient of mitigation finance and to receive more mitigation finance.

Including GDP per capita (WDI, 2013) tests whether mitigation finance as part of development aid also carries a development mission, i.e. is distributed to enhance economic growth and reduce poverty. The scope of GDP per capita to measure other development aspects is limited, hence infant mortality is also included in the main specification. Infant mortality is expected to correlate positively with mitigation finance. This variable is tested to further understand whether mitigation finance is allocated across developing countries as ODA co-benefits their social development. This might contradict the fact that developing countries with high emission levels have low infant mortality rates. The contradictory correlation can be used as an indicator that mitigation finance may not fulfill the original ODA initial objectives of improving social and economic conditions in poor countries.

The poverty gap index that measures the depth of poverty of people who live below poverty line is also taken into a consideration to capture other aspects of development, but its limited coverage significantly reduces the sample size, so income per capita and infant mortality are chosen as the best possible compromise. The high correlation between these two measurements (see Appendix 3.3) is thoroughly considered, and robustness checks are used to test the stability of the parameters. In the case of overall ODA, infant mortality is expected to be positive and significant.

Hypothesis #4A: The lower the GDP per capita of a developing country, the more likely it is to be selected as a recipient of mitigation finance and to receive more mitigation finance.

Hypothesis #4B: The higher the infant mortality rate of a developing country, the more likely it is to be selected as a recipient of mitigation finance and to receive more mitigation finance.

Control variables are foreign direct investment inflow (FDI), level of democracy, population size, ex-colonial and political ties and time dummies (see Table 3.3 in the end of this section). These variables are expected to have positive relationships with mitigation finance.

Donors may favour providing climate finance to protect their existing foreign investments (Buchner *et al.,* 2011, p. 12). Developing countries whose economy is more open to foreign investment may attract a higher volume of mitigation finance due to accelerate private investors that promote, for instance, renewable technological advancement tools. An open economy is often associated with donors' trade interests, in which aid can have a strategic role (Martínez-Zarzoso *et al.*, 2010). Donors are able to benefit from the aid they provide by imposing conditions, such as insisting that recipient governments spend their aid on products produced by donor-country companies (Hicks *et al.*, 2008b, p. 104). The percentage of FDI inflow of GDP (WDI, 2013) is a better measurement than the total volume of export and import since FDI inflow indicates wide access and flexibility for donor countries' businesses and companies to operate within the territory of recipient countries.

Hypothesis #5: The higher the FDI inflow of a developing country the greater the likelihood that it is selected as a mitigation finance recipient and receives more mitigation finance.

Democratic countries that exhibit a strong commitment to the international environment and demonstrate cooperative behaviour (Neumayer, 2002) may also show greater interest in being involved in reciprocal multilateral environmental action and hosting climate change mitigation projects. Alternatively, democratic states are arguably allowed more freedom of speech and a fair and transparent media which make it easy to disseminate climate-change-related information (Hicks *et al.*, 2008b). An updated version of the revised combined Polity Score, on a scale of 1 to 10 (10 being the most democratic) is used as a proxy for democracy (Keefer, 2010).

Hypothesis #6: The more democratic a developing country is, the greater the likelihood that it is selected as a mitigation finance recipient and receives more mitigation finance.

This chapter also tests whether mitigation finance is targeted at countries with large populations. In general aid studies, e.g. Anderson and Clist (2011), population is tested as a standard control of small-country bias – a coefficient of less than 1 indicates that recipient countries with smaller populations receive larger per capita aid than those with larger populations. The potential multicollinearity between population and CO_2 emissions is kept in mind (See the correlation between the two variables in Appendix 3.3).

Hypothesis #7: The larger the population of a developing country, the greater the likelihood that it is selected as a mitigation finance recipient and receives more mitigation finance.

Lastly, ex-colonial status was expected to have a positive relationship with mitigation finance, as Dolšak and Crandall (2013) have found it to be a determinant of CDM location. Studies of environmental aid allocation found a similar pattern; ex-colonies tend to receive more environmental aid (Hicks *et al*., 2008). Aid studies such as that of Burnside and Dollar (1997) show that donors tend to give development aid to their ex-colonies. This research investigates whether this is also the case in the allocation of official mitigation finance.

Hypothesis#8: Developing countries with historical and political ties tend to be selected as mitigation finance recipients and to receive more mitigation finance.

Total aid is not controlled for in the main regressions because adding this variable into the main specification would be problematic, especially in the regression analysis of poverty aid. Poverty aid as the dependent variable correlates strongly with total aid as the independent control variable (0.99). Indeed, including total aid in the main regression of mitigation finance will improve the rigour of regression model of mitigation finance. Hence where total aid is included in this model the coefficients of other main variables remain significant, and all the signs of these coefficients are consistent (figures available upon request).

All tested variables are summarised in Table 3.3 below and the data sources are presented in Appendix 3.2.

Table 3.3: Summary and descriptive statistics of dependent and independent variables

Variable	Label	Obs.	Mean	SD	Min	Max
Dependent variable (1998-2010)						
Commitment	binarycfcommit	2340	0.442	0.497	0.000	1.000
	binarypovaidcommit	2340	0.665	0.472	0.000	1.000
	binaryodacommit	2340	0.859	0.349	0.000	1.000
	lncfcommit	1034	13.744	2.915	3.059	21.711
	lnpovaidcommit	1555	5.758	1.454	-1.300	9.497
	lntotalodacommit	2009	19.202	1.682	10.597	23.863
Disbursement	binarycfdisburse	2340	0.428	0.495	0.000	1.000
	binarypovaiddisburse	2340	0.656	0.475	0.000	1.000
	binaryodadisburse	2340	0.859	0.349	0.000	1.000
	lncfdisburse	1002	13.356	2.494	6.016	20.715
	lnpovaiddisburse	1536	5.546	1.408	1.310	9.424
	lntotalodadisburse	1978	19.019	1.614	10.597	23.936
Independent variable						
Emissions	lnco2	1910	8.601	2.405	2.686	15.855
	lnch4	271	8.847	1.927	3.415	12.945
	lnn2o	267	7.999	2.058	1.834	12.215
	lnhfcs	164	5.005	2.440	-1.966	10.166
	lnpfcs	87	4.728	2.205	-3.507	8.773
	lnsf6	127	2.302	2.582	-3.912	9.439
	lnghg	246	10.607	1.863	3.851	14.798
CO_2 intensity	rci	792	1.222	1.119	0.273	10.854
Carbon sinks	lnforest	1820	6.956	3.025	-1.204	13.221
	marine	1650	4.431	10.001	0.000	75.360
Deforestation	deforest	2179	-0.241	1.303	-9.710	6.680
Governance	govern	1764	-0.306	0.755	-2.480	1.500
Income per capita	lngdppc	1991	7.345	1.416	4.415	11.121
Infant mortality	lninfant	2015	3.379	0.890	0.742	4.988
Population	lnpop	2158	15.165	2.238	9.141	21.000
FDI inflow	fdiinflow	1976	4.980	8.298	-37.616	167.300
Levels of democracy	democracy	1658	1.928	6.407	-10.000	10.000
Political interests	xcolony	2340	0.589	0.492	0.000	1.000
Regional dummies	eastsouthafrica	2340	0.150	0.357	0.000	1.000
	westafrica	2340	0.128	0.334	0.000	1.000
	eastasiapacific	2340	0.200	0.400	0.000	1.000
	southasia	2340	0.044	0.206	0.000	1.000
	easteurope	2340	0.111	0.314	0.000	1.000
	westeurope	2340	0.222	0.147	0.000	1.000
	middleeast	2340	0.083	0.276	0.000	1.000
	northafrica	2340	0.028	0.164	0.000	1.000
	latinamerica	2340	0.111	0.314	0.000	1.000
REDD+	reddplus	2340	0.255	0.436	0.000	1.000
Coalition dummies	smallisland	2340	0.228	0.419	0.000	1.000
	opecmember	2340	0.067	0.249	0.000	1.000

3.5. Estimators

To identify the determinants of foreign aid A, for a particular aid category j – either mitigation finance or poverty aid or overall ODA – at time t to a developing country i, this study tests the main variables in Eq. (1): emissions E_{it}, CO_2 intensity per unit of GDP C_{it}, carbon sinks S_{it}, deforestation D_{it}, governance G_{it}, and income per capita I_{it}:

$$A_{it}^{j} = \propto_0 + \propto_1 E_{it} + \propto_2 C_{it} + \propto_3 S_{it} + \propto_4 D_{it} + \propto_5 G_{it} + \propto_6 I_{it} + \propto_7 Z_{it} + \varepsilon_{it} \qquad (1)$$

Other variables are included as controls Z_{it} and unobservable factors are captured by residuals ε_{it}. Mitigation finance, poverty aid and overall ODA are measured in their absolute real values using US$ constant 2010 prices rather than measured per capita, and population is included as a control variable. All variables with nominal values are measured in logarithms. Time dummies are included in each regression but not presented in the results below. The hypothesis for each parameter is explained in a later section.

To estimate the parameters of equation (1), this research employs a two-part model following the approach used by Clist *et al.* (2011). The first part, the selection stage, uses a logit model to identify the determinants of developing country selection; the second part, the allocation stage, employs the ordinary least squares (OLS) model strictly to positive mitigation finance received at time t, dropping all zero and non-selected countries. The allocation stage identifies the determinants used to decide which recipients receive more mitigation finance.

The logit model is used rather than the probit model for a practical reason. The probit beta coefficient predicts the change in Z-score and requires further transformations to arrive at a meaningful result that is almost identical to the results of the logit.

The logit model is constructed based on the Bernoulli distribution (Gujarati & Porter, 2009, p. 822) with a discrete probability distribution comprising two binary events (in this study, receiving and not receiving aid). So when a developing country i at time t $t$receives an aid inflow, $A_{it}^{j} > 0$, this means that there is a successful observed event, Y=1. The probability of this event is denoted as $\hat{p}$, while the probability of an unsuccessful event, Y=0 - i.e. not receiving mitigation finance or aid - is denoted as $1 - \hat{p}$.

This multinomial logit model can be expressed mathematically as:

$$\ln\left(\frac{\hat{p}}{1-\hat{p}}\right) = \beta_0 + \beta_1 X_1 + \cdots + \beta_n X_n \tag{2}$$

Generally the logit model is a non-linear probability distribution function (*pdf*) of a set of parameters $\beta_0, \beta_1, \dots, \beta_n$. The odds ratio is determined by a set of variables X that represent characteristics of developing countries. These variables influence the natural logarithm (ln) of the odds $\frac{\hat{p}}{1-\hat{p}}$ – that is the probability of a developing country i receiving mitigation finance divided by the probability of its not receiving it.

The odds ratio is the odds of receiving foreign aid, *Y=1* given a characteristic X=1 divided by the odds of receiving mitigation finance Y=1 given a characteristic X=0. Mathematically the odds ratio can be expressed as:

$$Odds\ ratio = \frac{\left(\frac{\widehat{p_1}}{1-\widehat{p_1}}\right)}{\left(\frac{\widehat{p_0}}{1-\widehat{p_0}}\right)} \tag{3}$$

This study uses a simple logit model rather than the conditional logit model introduced by McFadden (1973) which leads to an incidental parameter problem (Baltagi, 2005, pp. 212-213), because this study has a large number of countries (180) over a short (13-year) period.

The two-part model is used for two reasons. First, this model is used in general aid allocation studies such as that of Clist (2011). Another reason is that not all of the observations can be included in a single model because the regressand is transformed into logarithmic form and the logarithm of zero is not defined, hence using OLS may lead to biased parameters. HSM is often used as an alternative to the two-part model, but does not allow the selection and allocation stages to be estimated using an identical set of variables. There is no underlying reason for having different lists of variables for the selection and allocation stages, hence this study uses the two-part model.

The first part of the two-part model accommodates the evaluation of this donor selection process. The two-step selection model is used for the allocation of climate finance by some donor agencies. Bilateral climate finance donors such as Germany's International Climate Initiative (ICI), implement the two-step selection approach (BMU, 2013). The ICI's first step is an annual call for proposals using the project outline template provided on its website. The selected applicants are then requested to submit a formal funding application, again using the templates provided (*ibid*). Some funding organisations, such as the Clean Energy Financing Partnership Facility (CEFPF) publish clear eligibility criteria for the funding application (see Annex in DECC (2012)). The two-part model selected in this chapter aligns with the two step selection process implemented by some climate dedicated climate funds.

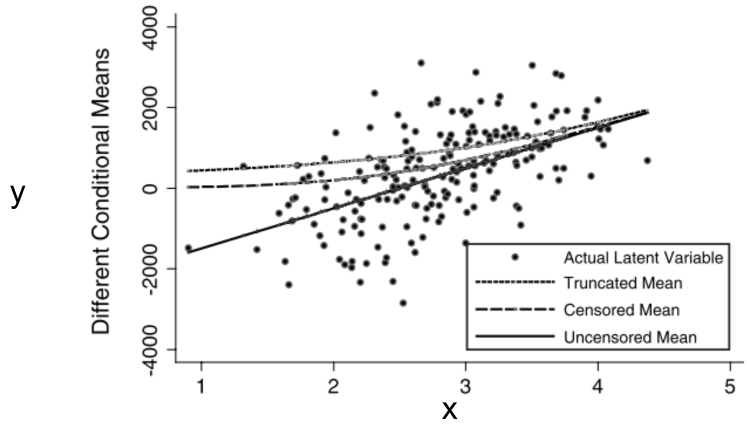
The CRS data used in this chapter are derived from project-level information and they are aggregated to become annual panel data. The issues surrounding the data in use are already discussed in section 1.3.1.

As explained in this earlier section, mitigation finance data before 2004 may not accurately represent the volume of mitigation finance inflow to developing countries due to many unreported development projects before 2004. To verify the consistency of the coefficients resulted from estimations of mitigation finance before and after 2004, section 3.7 compares the estimations of mitigation finance in the period of 1998-2004 with those of 2005-2010.

The dataset used in this study is truncated. Truncation is defined as occurring when some observations on both dependent and independent variables are lost; censoring occurs when only the dependent variable is cut below or above a certain level (Cameron & Trivedi, 2005, p. 529). The censored data, for example is a dataset of the dependent variable, e.g. mitigation finance inflow to 'developing countries', only covers middle-income countries, leaving out poor and rich developing countries whose income per capita is below or above certain levels. When the data are truncated, the application of OLS may lead to biased estimates (Cameron and Trivedi 2005, p. 530). When the dependent variable data are missing, the possible effect of using OLS is to cause a shift of the intercept. Nevertheless in some cases, the effect can also lead to an inconsistent slope, as the mean of the truncated data (labelled as 'truncated mean' in Figure 3.6) may be lower or higher than the mean of the non-truncated or non-truncated data (labelled as 'non-censored mean').

Figure 3.6 shows a two-way scatter plot that illustrates how the slope changes when the hypothetical dependent variable y is cut-off at point 0. Without the cut-off, ideally the slope will have a mean presented as the solid line. When this dependent variable is censored while the data of independent variables are complete or full observed, the slope is uplifted and the constant term also starts from point zero, as shown by the dashed line. If x and y are truncated, the truncated mean is higher than the censored mean shown by the dotted line.

Figure 3.6: Censored and truncated means when mitigation finance censored at 0



This figure is from Cameron and Trivedi (2005)

As in the case of mitigation finance data, this cut-off point is not zero as there is no negative allocation, and besides this, each donor may have a different cut-off point.

Some donors do not report the relatively little amounts of mitigation finance often used to finance small-scale pilot projects. In this case, the annual mitigation finance data A_{it} is cut from below or denoted at point L. For the observed observations that are incomplete is denoted as A_{it}^* and the unobserved ones are known as missing. Hence the available observations lie on the outside of relevant bound. The available observations that are observed A_{it}^* are only those larger than L.

This can be expressed as:

$$A_{it} = A_{it}^* \text{ if } A_{it}^* > L \quad (4)$$

Other donors may consider not reporting or coding a large financial inflow to a development project as mitigation finance since tagging it as mitigation finance may change the overall outlook of their ODA distribution, which ideally focuses on recipients' local and national development rather than global development. When such a large amount of mitigation finance is not reported, the annual mitigation finance data A_{it} is cut from above, or denoted at point U. Hence the existing observations are those that are smaller than U.

$$A_{it} = A^{*}_{it} \text{ if } A^{*}_{it} < U \qquad (5)$$

When cuts occur from both below and above, the existing observed data are larger than L and smaller than U and therefore the relevant bound is contracted.

$$A_{it} = A^{*}_{it} \text{ if } L < A^{*}_{it} < U \qquad (6)$$

The cuts from below and above occur at unknown levels and it is almost impossible to predict the cut-off points. There is a lack of explanation for why some projects are not coded. Development projects in the early years of CRS code implementation may not be coded due to project implementers' lack of awareness about the need to report them. For similar reasons, donors may also over-code development projects, counting non-climate projects as climate and mitigation projects. Michaelowa and Michaelowa (2011) interpret this as a violation of the coding rules, motivated by donor governments' political interests and environmental preferences, first by the percentage of the population in the donor country that perceives global warming as a serious matter and second by the percentage of green party seats in parliament.

Where such over-reporting due to political motives occurs it leads to overestimation of the sample mean, shifting the dotted line in Figure 3.6 further upward, while underreporting due to the removal of many uncoded projects in the period 1998-2003 (as shown in Chapter 1, Table 1.2) shifts the sample mean down, potentially underestimating it. These inherent distortions of the mitigation finance data affect the accuracy of the representation of the real volume of mitigation finance inflows to developing countries. Hence a caveat applies that the sample mean of the available data should only be taken as an approximation when estimating the mean of the original population of mitigation finance inflows.

As mentioned earlier, in this chapter some independent variables also have observations missing due to different data providers' selection of samples. The UNFCCC's GHG emission data are only available for a few countries; WGI governance data only cover 168 of 180 developing countries in this study; the data for the trend of CO_2 intensity per unit of GDP (*rci*) only covers 95 developing countries, and most data providers do not provide sufficient explanation for why they do not include certain countries.

The Tobit model is not selected due to the unknown truncation point of the mitigation finance data. There is lack of information that explains or verifies the minimum threshold or ceiling amount at which donors decide not to report their development projects. The Heckman selection model (HSM) (Tobit model type II) is often used as an alternative to the two-part model, but does not allow the selection and allocation stages to be estimated using an identical set of variables. There is no underlying reason for having different lists of variables for the selection and allocation stages, hence the study in this chapter uses the two-part model.

The assumption of the two-part model is that Rho − indicating the degree of the residuals' independence from the two stages − equals zero. In other words, the residuals at both stages should not be correlated. The tests for assumptions find that the residuals of the two stages indicate a degree of correlation, violating the assumption of the two-part model. Table 3.4 shows that the rho **(ρ)**, which tests whether χ^2 is equal to zero, is strongly rejected, indicating the correlation between error terms of selection and allocation stages in the case of both mitigation finance commitment and disbursement. The p-values in both cases are (0.008) and (0.006) with χ^2 =7.000 and 7.470 respectively. On the other hand, the tests for poverty aid commitment and disbursement as well as overall ODA disbursement do not show strong evidence to reject the null. The associated p-values to **(ρ)** is greater than 0.1 indicating that in these two latter cases, the error terms between selection and allocation stages are independent.

Table 3.4: Diagnostics of Normality and Homoscedasticity

Dependent variable	**Normality Sktest Adjusted χ^2**	**Homoscedasticity Breusch-Pagan/ Cook-Weisberg test (χ^2)**	**Wald test $\rho = 0$ χ^2**
Commitment			
Log of mitigation finance	20.01	50.09	7.000
	(0.000)	(0.000)	(0.008)
Log of poverty aid	6.42	16.36	2.160
	(0.040)	(0.000)	(0.142)
Log of overall ODA	8.02	19.94	7.470
	(0.018)	(0.001)	(0.006)
Disbursement			
Log of mitigation finance	16.45	50.22	4.140
	(0.000)	(0.000)	(0.042)
Log of poverty aid	30.55	50.77	0.220
	(0.000)	(0.000)	(0.637)
Log of overall ODA	33.69	33.48	0.010
	(0.000)	(0.000)	(0.903)

Note: P-values in parentheses

To anticipate having biased coefficients from the use of the two-part model due to a violation of the assumption of independent error terms between the two stages, Appendix 3.4 presents the estimations using HSM, which allows the correlation of error terms between the two stages.

Neither normality nor homoscedasticity are necessary conditions for consistent parameters in the two-part model (Cameron & Trivedi, 2005, pp. 534-538). To explore the characteristics of mitigation finance, poverty aid and overall ODA data, Table 3.4 also shows the results of normality and heteroscedasticity tests applied to the residuals of estimations for the three aid categories. There is strong evidence that the residual errors are not normally distributed and homoscedastic. The p-values of the skewness and Breusch-Pagan tests are below 0.01, indicating strong rejection of the null hypotheses that the residuals from all estimations are normally distributed and homoscedastic. Robustness checks are used to verify the consistency of the level of significance and the coefficients due to the non-normal and heteroscedastic nature of ,mitigation finance, poverty aid and overall ODA data.

Using the two-part model involves a conceptual choice of which type of logit model is appropriate considering the characteristics of mitigation finance data. The fixed effect or conditional logit model (CLM) introduced by McFadden (1973) is a possible alternative to the simple logit for estimating panel data. CLM controls for qualitative choice behaviour, not only across developing countries but also within developing countries. The Hausman test indicates whether a fixed or a random effect model is more appropriate. The results show strong evidence at the 1% level, rejecting the null hypothesis that is the unobserved effects are uncorrelated with the explanatory variables. We the null is rejected, there is strong evidence that unobserved effects are correlated with the explanatory variables and creates inconsistency of the random effects.. This suggests the use of a fixed effect logit model or CLM.

Using CLM, the majority of coefficients become statistically insignificant (the results are not reported, but are available upon request). Baltagi (2005, pp. 212-3) notes that in the case of large samples N, residual errors are difficult to estimate consistently using CLM. Insignificant and inconsistent coefficients may occur due to problems with controlling fixed effects that are inherent in the logit model. The application of CLM when datasets are characterised as short panel data often leads to inconsistent estimates: this is known as an *incidental parameter problem* (*ibid*). When the time goes to infinity the fixed-effect estimator is consistent, but if the period of observation is short and the number of countries continues to increase, the fixed effects of individual effects that are unique to each observation are inconsistent, as the number of these parameters increases along with the increase in the number of cases (*ibid*, p.13).

The panel data in use is considered as a short panel data with a large number of cases (180 developing countries) over only a short period of 13 years.

Experiments using restrictive samples for specific regions demonstrates this inconsistency issue with CLM (see Appendix 3.5, Table 3.16). The resulting estimation for only African countries (*eastsouthafrica==1 and westafrica==1*) finds the beta coefficient of *lnpop* to be negative and significant at 5% c79, but in c80, it is positive and significant when the estimation covers only European countries (*easteurope ==1 and westerneurope ==1*).

Compared to CLM, the simple logit model does not include fixed effects, and this is the model's major pitfall. However, it can also be advantageous. If the focus of the study is to test some fixed or invariant variables (dichotomous or categorical variables), simple logit requires and allows for the inclusion of some fixed variables in the specification. The remaining factors, which cannot be observed, are captured by the residuals. To control the omitted variable bias, the robustness check specification includes all regional dummies (except Caribbean), dummy variables such as Reducing Emissions from Deforestation, and Forest Degradation (REDD+), and regional and coalition dummies. Including them as control variables allows this study to identify the effect of these particular fixed country characteristics.

Other aid studies also use simple logit models to analyse panel data. Clist (2011) and Michaelowa and Michaelowa (2011) analyse global foreign aid allocation and the global factors that influence donors' reporting behaviours respectively. They use simple logit models as the CLM does not allow the inclusion of the important time-invariant variables that they aim to analyse. By contrast, Blaise (2005) does use the CLM to estimate the regional allocation of Japanese private investment in China, possibly because he has data with continuous values and analysing the effect of time-invariant variable is not a central element of his study.

3.6. Developing countries' characteristics and mitigation finance

This section presents the results of the inquiry into the two stages of mitigation finance allocation. At the selection stage some variables consistently determine the allocation of mitigation finance, but at the allocation stage only a few determinants affect mitigation finance. The analysis of the selection stage is followed by that of the allocation stage. Separate results are presented for finance commitments and disbursements.

3.6.1. Mitigation finance commitment: Selection

Five parameters variables are significant determinants of mitigation finance commitments at the selection stage (see Table 3.5, column 1 (c1)). Carbon sinks (*lnforest*), governance (*govern*), income per capita (*lngdppc*), population (*lnpop*), and democracy (*democracy*) are statistically significant at 1%. The robustness checks c2 show that the first three are stable and significant; *lnpop* and *democracy* are statistically insignificant and *lninfant* is significant at 10%.

Table 3.5: Selection and allocation stages of mitigation finance commitment and disbursement

Type of data:	Commitment				Disbursement			
Stage:	Selection		Allocation		Selection		Allocation	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
lnco2	0.128	0.188	0.092	0.190	-0.034	0.093	0.277**	0.445***
	(1.357)	(1.522)	(0.717)	(1.282)	(-0.352)	(0.732)	(2.278)	(3.265)
lnforest	0.208***	0.171***	0.070	0.159*	0.275***	0.286***	0.054	0.087
	(5.358)	(3.263)	(1.113)	(1.924)	(6.600)	(5.044)	(1.112)	(1.327)
deforest	-0.014	-0.049	0.289***	0.136	0.072	0.038	0.235***	0.125*
	(-0.242)	(-0.782)	(3.346)	(1.488)	(1.088)	(0.547)	(3.399)	(1.704)
govern	0.786***	1.201***	1.177***	0.869***	0.891***	1.233***	1.123***	0.978***
	(3.822)	(4.748)	(4.376)	(2.787)	(4.172)	(4.756)	(5.144)	(4.198)
lngdppc	-0.489***	-0.691***	-0.551***	-0.405*	-0.290*	-0.496**	-0.806***	-0.844***
	(-3.250)	(-3.386)	(-2.875)	(-1.771)	(-1.953)	(-2.384)	(-4.640)	(-4.301)
lninfant	0.008	0.407*	-0.155	-0.056	0.193	0.576***	-0.353*	-0.099
	(0.045)	(1.906)	(-0.678)	(-0.201)	(1.052)	(2.618)	(-1.816)	(-0.463)
lnpop	0.319***	0.253	0.669***	0.492***	0.433***	0.292*	0.444***	0.143
	(2.647)	(1.599)	(4.203)	(2.733)	(3.573)	(1.839)	(2.860)	(0.856)
fdiinflow	0.018	0.025	0.052***	0.059***	0.014	0.021	0.013	0.033
	(0.929)	(1.260)	(3.156)	(3.565)	(0.861)	(1.320)	(0.656)	(1.584)
democracy	0.041***	0.006	0.004	0.014	0.031**	0.001	0.020	0.020
	(2.898)	(0.368)	(0.208)	(0.614)	(2.171)	(0.053)	(1.178)	(1.213)
xcolony	-0.116	0.132	-0.058	-0.308	-0.074	-0.082	-0.004	0.078
	(-0.685)	(0.567)	(-0.247)	(-1.109)	(-0.425)	(-0.340)	(-0.022)	(0.319)
eastsouthafrica		-2.046***		0.708		-1.074*		-0.395
		(-3.320)		(0.910)		(-1.726)		(-0.640)
westafrica		-2.736***		0.316		-1.758***		-1.325**
		(-4.318)		(0.396)		(-2.816)		(-2.009)
eastasiapacific		-1.294**		0.798		-0.741		0.065
		(-2.307)		(1.181)		(-1.271)		(0.135)
southasia		-0.684		1.290		0.851		0.936
		(-0.936)		(1.596)		(1.195)		(1.573)
easteurope		-1.184*		0.686		-0.475		-0.552
		(-1.782)		(0.835)		(-0.696)		(-0.890)
westeurope		-2.058***		2.852***		-0.355		2.149***
		(-2.662)		(2.660)		(-0.440)		(2.722)
middleeast		-1.453**		-0.060		-0.425		-1.572**
		(-2.216)		(-0.073)		(-0.616)		(-2.267)
northafrica		-0.524		2.909***		1.273*		1.103
		(-0.796)		(3.357)		(1.850)		(1.585)
latinamerica		-0.299		0.002		0.004		-0.388
		(-0.464)		(0.003)		(0.006)		(-0.667)
reddplus		0.471**		0.373		0.858***		0.261
		(2.108)		(1.441)		(3.593)		(1.202)
smallisland		0.089		0.676		0.912**		0.231
		(0.228)		(1.375)		(2.121)		(0.511)
opecmember		-0.766**		-1.576***		-1.032***		-1.078***
		(-2.293)		(-3.770)		(-2.907)		(-2.889)
χ^2	276.9	308.5			317.9	356.9		
R^2			0.268	0.325			0.345	0.435
Adjusted R^2			0.247	0.292			0.325	0.406
P-values	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	1146	1146	669	669	1146	1146	638	638

Note: Heteroscedasticity-corrected z or t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

This section further analyses the results given in Table 3.5 and explains the application of logit model and its interpretation for some of the coefficients derived using this model.

Carbon sinks (lnforest)

Table 3.5 c1 shows evidence that developing countries with large forest areas tend to receive mitigation finance. At the selection stage the coefficient of *lnforest* is 0.208, implies that the odds of being selected as a recipient of mitigation finance rise by 2.1% (0.10x0.208=0.021) if forest area rises by 10%. One should read this calculation with the caveat that due to the truncation of the data, explained in section 2.3, the figures should only be treated as proximities. These positive relationships show that the odds increase with the expansion of carbon sink. However, reforestation projects such as REDD+ have economic trade-offs such as giving up agricultural land to create protected forest areas (Kanowski *et al.*, 2011).

Governance

Good governance is another influential parameter of mitigation finance. At the selection stage, governance is positive and significant at the 1% level, consistent with the finding of Hicks *et al.* (2008, pp. 112-114), who however only test 'government effectiveness' and find it to be positive and significant at the 5% level for bilateral and multilateral green and brown environmental aid at the selection stage. This determinant is used as a gatekeeper to minimise ineffective aid spending due to insufficient policy frameworks to regulate and monitor it.

Income per capita

Conversely, *lngdppc* exhibits a negative relationship with mitigation finance, *ceteris paribus.* Poorer developing countries appear to be selected as mitigation finance recipients. When GDP per capita decreases by 1%, pledges of mitigation finance rise by about 0.49%, significant at the 1% level, *ceteris paribus*. This finding aligns with the finding of Hicks *et al.* (2008) who show a negative relationship between income per capita and environmental aid and green aid. On the contrary, Figaj (2010) finds no influence of income per capita in the environmental aid allocations of Japan, GEF and the World Bank. A negative relationship between mitigation and income per capita shows that mitigation finance includes a development mission, but the economic-development indicator *lngdppc* has a larger and more statistically significant impact than the social-development indicator *lninfant*.

To anticipate potential multicollinearity, *lninfant* and *lngdppc* were tested in turn. The results show that *lnforest, deforestation, governance, lngdppc, lnpop, fdiinflow* and *democracy* are consistently significant and stable (See Appendix 3.5, Table 3.15) The main model in this chapter includes both infant mortality and income per capita to capture both economic and social aspects of development. The χ^2 is higher with *lninfant* (308.5) than without *lninfant* (276.8) although the adjusted R^2 of the allocation stage is slightly lower with *lninfant* (0.247) than without it (0.248). This indicates that including *lninfant* improves the explanatory power of the main specification (c1) and does not distort the consistency of other parameters than when excluding it.

Two control variables at the selection stage, *lnpop* and *democracy*, both significant at 1%, influence the probability of a developing country being selected to receive mitigation finance. There is a small-country bias at both stages. Most of the beta parameters of *lnpop* are less than 1. Small countries' position may not be overlooked in the international climate change community as they receive more mitigation finance per head than large countries. The result of the main estimation agrees with Lewis' (2003) and Hicks *et al.*'s (2008) findings that *democracy* is a positive determinant of environmental aid.

3.6.2. Mitigation finance commitment: Allocation

At the allocation stage, deforestation rate (*deforest*), governance (*govern*), income per capita (*lngdppc*), population (*lnpop*) and FDI (*fdiinflow*) determine commitment to allocate mitigation finance. At the allocation stage, the coefficients of deforestation rate (*deforest*) and FDI (*fdiinflow*) are statistically insignificant. Only at the allocation stage, these coefficients are statistically significant indicating that deforestation rate and FDI determine the allocation decision of which country receives more mitigation finance.

The results in Table 3.5, c3 shows a positive relationship between deforestation rate and mitigation finance, the higher the deforestation rate, the higher mitigation finance inflow to a recipient country – significant at 1% level. If a country's deforestation rate within a given period increases by 10%, the country tends to receive 2.8% higher mitigation finance.

At the allocation stage, the governance variable (*govern*) has a significant coefficient of 1.177 (Table 3.5, c3); this means, *ceteris paribus,* that a 0.1 increase in the governance index tends to increase the allocation of mitigation finance by 11.8%. This shows donors appreciate and reward recipients that have a better policy environment, possibly because climate change projects such as reforestation rely on this being in place.

A negative relationship between mitigation finance inflow and GDP per capita is also found at the allocation stage. Significant at 1%, the coefficient of *lngpdpc* is -0.551. This negative sign indicates that for every 1% lower

GDP per capita, pledges of mitigation finance tend to rise by about 0.55%, *ceteris paribus*. In 2010, donors made mitigation finance pledges to provide mitigation finance for Kazakhstan and Cameroon. GDP per capita of Kazakhstan and Cameroon is respectively US$ 9,070 and US$ 1,147. Cameroon's GDP per capita is 87.35% (100*((9070-1147)/9070) lower than Kazakhstan's GDP per capita. According to the beta coefficient, Cameroon tends to receives 48% (87.35*0.55) higher amount of mitigation finance than Kazakhstan.

The coefficient of population variable (*lnpop*) is also positive and significant (c3) indicating that larger developing countries receive more mitigation finance commitment. Having most of the beta parameters of *lnpop* smaller than 1 indicates that each individual in small developing countries tends to receive a higher amount of mitigation finance on per capita basis than large developing countries. Hicks *et al.* (2008) find a similar pattern for brown and green aid.

Recipients with higher FDI inflow incentivise donors to pledge a greater amounts of mitigation finance investment, perhaps because mitigation finance can indirectly support and protect the investments of donor-country companies. Developing countries with large FDI may allow the direct transfer and application of technological innovation for reducing carbon emissions (Dechezleprêtre *et al*., 2011).

One of the main parameters, *lnco2,* is insignificant at both stages. Although the coefficient is positive as expected, it is not statistically significant. Donors may use mitigation finance as an incentive to invite developing countries with greater capacity (larger *lnforest*) to join in global emission reduction, rather than the countries with greater responsibility to reduce emissions (higher *lnco2*). The variable of historical ties *xcolony* is also insignificant at both stages, which contrasts with the results of Hicks *et al.* (2008) find it significant for bilateral and multilateral green aid. It is possible that using mitigation finance for political reasons is restricted by the narrower objectives of mitigation finance.

The Wald test examines whether the parameters of interest are simultaneously equal to zero indicating they do not improve the fit of the model and there is a strong suggestion to remove them. When the three insignificant regressors (*lnco2, lninfant, xcolony*) are dropped, the χ^2 value of joint significance is higher (commitment: 181.19, disbursement: 181.87) than when including only significant regressors (commitment: 134.08, disbursement: 141.02). P-values associated with χ^2 show strong evidence to reject the null, indicating that these three variables are not simultaneously equal to zero and including them improves the fit of the model.

3.6.3. Mitigation finance commitment vs disbursement

An important difference between commitment and disbursement is that *lnco2* becomes statistically significant in the selection stage for disbursement. In the allocation stage of mitigation finance disbursement (c7), *lnco2* is positive and significant at 5% and consistently significant (c8) at 1%. Previously, *lnco2* was insignificant, but it becomes significant determinant of mitigation finance disbursement.

As a separate exercise Heckman's selection model is performed to verify the consistency of *lnco2*. Appendix 3.4, Table 3.14 shows that *lnco2* is insignificant for mitigation finance disbursement (c73, c74), but significant for mitigation finance commitment at 10% (c71). There is an indication of a sub-optimal use of *lnco2* as a determinant of mitigation finance allocation.

This variable is an insignificant determinant in decision-making about allocation until the actual aid transfer stage. Perhaps there is a fear using this parameter will divert ODA to industrial developing countries and these countries with better economies are more entitled to mitigation finance than poorer and non-industrial ones.

3.6.4. *Marginal effects*

Marginal effects (ME) are an alternative way of interpreting the coefficient in the logit model and are more straightforward than using odd ratios. ME show the change in the expected probability of receiving mitigation finance or overall ODA E(*Y=1*) if an independent variable, for example governance, increases by one unit, *certeris paribus.* ME are often used when the independent variable is discrete rather than continuous. By contrast, the odds ratio is a ratio of ratios and has two different unknowns ($\widehat{p_1}$ and $\widehat{p_0}$). So the odds ratio of a parameter could be derived from many different combinations of $\widehat{p_1}$ and $\widehat{p_0}$.

To explain ME, Bartus (2005) considers the single-equation regression model

$$E(y) = F(\beta x) \quad (7)$$

$$E(y) = F(\beta_1 x_2 + \beta_2 x_2 + .. + \beta_j x_j) \quad (8)$$

Eq. (7) and its longer form in Eq. (8) denote a linear combinations of the standard basis vectors with *j*th explanatory variable x and $F(.)$ is the cumulative distribution function (CDF) that maps the values of βx to the [0,1] interval (*ibid*). Reflecting from the standard interpretation of the linear statistical model, the marginal effect in the logit model can be expressed as:

$$\frac{d\,\Pr[Y=1|x_j]}{dx_j} = F'(\beta x) \qquad (9)$$

The marginal effect in the logit model is a derivative function of the CDF or the probability density function (*pdf*) of x_j for the probability of a successful event, $Y = 1$, i.e. receiving mitigation finance. The marginal effect estimates the change in the expected probability of receiving mitigation finance if a variable, x_1, i.e. *lnco2*, increases by 1%.

The average marginal effect (AME) is the average of the difference of two CDFs from two possible outcomes (successful and unsuccessful), with the values of all other independent variables remaining as they are. For example, for a particular explanatory dummy variable, x_j, i.e. *xcolony* dummy, a developing country's characteristic whether it is an ex-colony of a DAC donor or not. As expressed in Eq. (10), first AME computes the CDF for observation-k when a developing country is an ex-colony of DAC donors, $x_j^k = 1$, holding everything else constant. This value is then substracted by the CDF for the observation-k when it is tagged as non-DAC-ex-colony, $x_j^k = 0$. AME calculates the sum of differences between the first and second case and divides this total value by n number of observation.

$$AME_j = \frac{1}{n}\sum_{k=1}^{n}\{F(\beta x^k|x_j^k = 1) - F(\beta x^k|x_j^k = 0)\} \qquad (10)$$

Marginal effect calculates an effect on the dependent variable for a particular difference of an explanatory variable, such as the difference of colonial status in the given example above, while having everything else constant, hence it is also often called 'partial effect'.

Another way to express the partial effect of a change in an explanatory variable is by having all variables at their mean values. This is known as Marginal Effect at Mean (MEM). As shown in Eq. (11), theoretically it is possible to calculate the effect of change of colonial status. Firstly, calculate the PDF when the average of colonial status equal to one having other independent variables at their mean values, then substract this function with PDF when the average of colonial status is zero.

$$MEM_j = F\left(\beta\bar{x}|\bar{x}_j = 1\right) - F\left(\beta\bar{x}|\bar{x}_j = 0\right) \quad (11)$$

Many applied econometrians argue that AME offers a more meaningful explanation that MEM, when the majority of independent variables are discrete rather than continuous. This computation of x_j at its representative value is useful to avoid having a dichotomous variable computed at its mean value. For example, if other characteristics of country are expressed as a dichotomous variable, e.g. a landlocked state is coded as 1 or 0, the mean value does does not offer any logical explanation since there is no country with a quasi-landlock characteristic.

Nevertheless, in this chapter, the main explanatory variables under investigation are continuous rather than discrete. When x_j is continuous rather than discrete, AME only estimate the effect of an infinitely small change (*ibid*). Eq. (12) shows the components to arrive at AME for the j-th continous explanatory variable. The calculation is derived from the derivate function in respect to βx. The AME for a continuous explanatory variable-j is the average of the sum of *pdf* for a combination vector βx^k with Δx_j signifying the degree of change of x_j.

$$AME_j = \Delta x_j \beta_j \frac{1}{n} \sum_{k=1}^{n} f(\beta x^k) \tag{12}$$

The MEM for a continuous explanatory variable-j is composed by the derivative of $\beta\bar{x}$ representing the vector of a linear combination with the explanatory variables (in the case of multivariate analysis) are all at mean values. When $\Delta x_j = 1$, or x_j is varying by one unit, then MEM for variable-j can be expressed as shown in Eq. (13).

$$MEM_j = \beta_j f(\beta\bar{x}) \tag{13}$$

There are two ways to translate these formulas to obtain AME and MEM. Manually, as in Eq. (13), MEM can be computed by inserting the coefficient in Table 3.5, c1: for example to calculate MEM of *lnforest,* is to multiple $\beta_{lnforest}$ =0.208 with the *pdf* of mitigation finance at its mean value $\bar{x}$ = 0.620. Hence its MEM of *lnforest* is as much as 0.208*0.620 *(1-0.620)= 0.049 (This is equal to *lnforest* in Table 3.6, c9 computed by STATA).

Table 3.6: Marginal effects of parameters on mitigation finance (selection stage)

	MEMs	**AMEs**	**MER (1) (ex-colony = 1)**	**MER (2) (ex-colony = 0)**
	(9)	(10)	(11)	(12)
lnco2	0.030	0.020	0.021	0.021
	(1.360)	(1.360)	(1.360)	(1.360)
lnforest	0.049***	0.033***	0.034***	0.038***
	(5.360)	(5.540)	(5.550)	(5.550)
deforest	-0.003	-0.002	-0.002***	-0.002***
	(-0.240)	(-0.240)	(-0.240)	(-0.240)
govern	0.185***	0.128***	0.129***	0.127***
	(3.820)	(3.920)	(3.910)	(3.920)
lngdppc	-0.115**	-0.079***	-0.080***	-0.079***
	(-3.240)	(-3.290)	(-3.310)	(-3.920)
lninfant	0.002	0.013	0.001	0.089
	(0.004)	(0.040)	(0.040)	(0.040)
lnpop	0.075***	0.052***	0.052***	0.052***
	(2.660)	(2.680)	(2.670)	(2.700)
fdiinflow	0.004	0.003	0.003	0.003
	(0.930)	(0.930)	(0.930)	(0.930)
democracy	0.010***	0.007***	0.007***	0.007***
	(2.900)	(2.940)	(2.940)	(2.943)
xcolony	-0.027	-0.018		
	(-0.690)	(-0.690)		

Note: z-values in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

MEM of *lnforest* equals to 0.049; this means that a 1% increase of forest area consequently increases the probability of receiving mitigation finance by 4.9%. Despite the difficulty of implementing reforestation projects that involve economic trade-offs such as giving up land that can be used for commercial purposes such palm-oil plantation, the incentives that donors offer to developing countries for mitigating their national GHG emissions are relatively small.

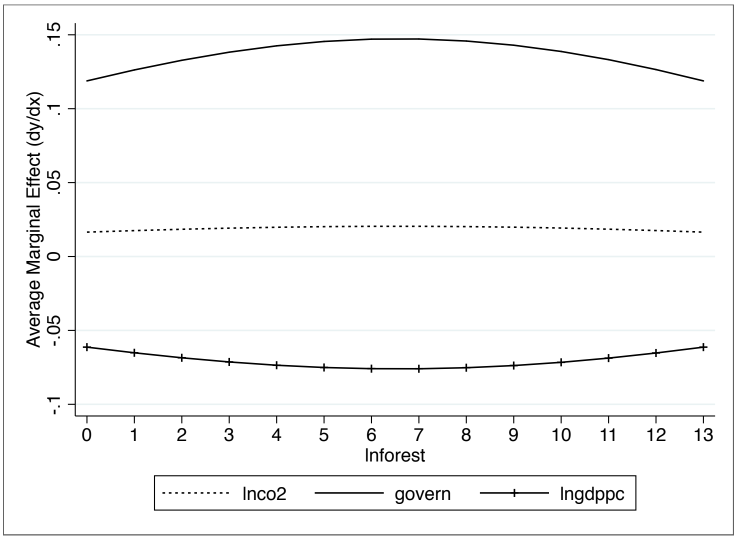
Additionally, a rapid expansion or protection of forests without careful social and economic planning can, potentially restrict local communities' access to the forest resources on which they depend. Uncoordinated planning and implementation of reforestation and local and community economic development may interrupt the sustainability of the income of the communities or regions involved.

For comparison purposes, Table 3.6 presents the marginal effects at three different scenarios: Marginal Effects at Means (MEMs), Average Marginal Effects (AMEs), and Marginal Effects at Representative Values (MERs) of ex-colony equals to 1 and 0, having the other independent variables at mean values.

When all the other independent variables are held constant at their mean values (MEMs) c9, the probability of a developing country being eligible for mitigation finance commitment is 18.5% higher for every 0.1 increase of average governance index, *ceteris paribus*. While holding everything else constant, for every additional 1% increase of income per capita, the probability of a developing country being eligible for mitigation finance commitment is decreasing by 11.5%. Having 1% larger population increases the eligibility for mitigation finance by 7.5%, *ceteris paribus*. If a democracy index of a developing country is increasing by one unit, its eligibility to receive mitigation finance increases by 1%. In general, governance and income per capita are more influential determinants than other donors since its marginal effects change significantly the probability of a developing country to be mitigation finance recipient.

Most of the independent variables in Table 3.6 are continuous rather than discrete. Therefore, as explained earlier, AME only estimates an infinite small change. This is proven by when AME for *lnco2, govern,* and *lngdppc* are calculated at different representative values of *lnforest,* from 0 or 13 (maximum). Figure 3.7 visualises a small variation in the magnitude of the effects of *govern* and *lngdppc.*

Figure 3.7: Average Marginal Effects (AMEs) at representative values of lnforest



Source: by author adopted from STATA 12 output

Tables 3.7 and 3.8 show the estimation results from the relationship tests between mitigation finance and other emission gases and carbon sinks. Some estimation results suffer from the limited number of observations, but are nevertheless included for comparison.

Table 3.7: GHG emissions and mitigation finance commitment

	Selection						Allocation					
	$GHGs^{+}$	CH_4	N_2O	HFCs	PFCs	SF_6	$GHGs^{+}$	CH_4	N_2O	HFCs	PFCs	SF_6
	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
lnco2		-0.566	-0.835***	-2.663**	-1.025	-0.207		0.081	-0.619	-0.664	1.269	-4.698*
		(-1.635)	(-2.615)	(-2.537)	(-0.648)	(-0.172)		(0.140)	(-1.125)	(-0.746)	(0.168)	(-1.790)
lnforest	0.678***	0.570***	0.566***	0.095	1.053**	2.140***	0.120	0.395	0.081	-0.036	1.862	-0.949
	(4.302)	(2.729)	(3.594)	(0.333)	(2.365)	(2.830)	(0.403)	(1.352)	(0.319)	(-0.121)	(0.611)	(-0.839)
deforest	-0.091	-0.052	-0.096	-0.555	1.842**	0.833	0.291	0.153	0.107	0.411	-5.753	-1.776
	(-0.471)	(-0.278)	(-0.515)	(-1.220)	(2.005)	(0.994)	(1.054)	(0.584)	(0.405)	(0.517)	(-0.346)	(-0.749)
govern	1.835***	1.842***	1.608**	0.702	2.689	4.422***	0.458	0.195	0.505	1.705	21.723	-0.138
	(2.697)	(2.917)	(2.563)	(0.585)	(1.118)	(2.791)	(0.370)	(0.177)	(0.444)	(1.000)	(0.786)	(-0.032)
lngdppc	-0.314	-0.142	0.058	-0.343	0.109	-1.396	0.452	0.691	0.679	0.148	-10.500	3.556
	(-0.799)	(-0.395)	(0.161)	(-0.574)	(0.101)	(-1.541)	(0.856)	(1.417)	(1.307)	(0.199)	(-0.828)	(1.323)
lnghgcom	-0.538						-0.263					
	(-1.511)						(-0.564)					
lnch4		-0.324						-1.430*				
		(-0.898)						(-1.770)				
lnn2o			-0.379*						-0.082			
			(-1.815)						(-0.341)			
lnhfcs				0.778***						0.488**		
				(2.681)						(2.204)		
lnpfcs					-0.845						-0.733	
					(-1.598)						(-0.479)	
lnsf6						0.875**						-0.919
						(2.330)						(-0.956)
χ^2	51.4	55.1	63.0	36.3	33.6	28.4						
R^2							0.286	0.326	0.298	0.587	0.870	0.673
Adjusted R^2							0.060	0.109	0.072	0.312	-0.434	0.170
P-values	0.000	0.000	0.000	0.014	0.029	0.100	0.001	0.000	0.001	0.000	-0.434	0.170
N	171	187	186	111	57	81	80	83	83	51	23	34

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively. $^{+}$A mixed of CO_2, CH_4, N_2O in CO_2e. Negative coefficients of *lnco2* potentially are due to multicollinearity between *lnco2* and other GHG. When *lnco2* is omitted, in both stages, *lnch4* becoming statistically significant respectively at 10% and 5% levels; whereas all other variables remain stable except for *lnn2o* which becoming insignificant.

Table 3.8: GHG emissions and mitigation finance disbursement

	Selection						Allocation					
	GHGs+	CH_4	N_2O	HFCs	PFCs	SF_6	GHGs+	CH_4	N_2O	HFCs	PFCs	SF_6
	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)
lnco2		-0.286	-0.594*	-1.445	-3.426**	-0.824		-0.147	0.265	-0.259	-1.108	-3.480
		(-0.828)	(-1.775)	(-1.175)	(-2.061)	(-0.683)		(-0.219)	(0.448)	(-0.199)	(-0.136)	(-1.487)
lnforest	0.429**	0.514**	0.412**	-0.094	0.718*	2.581**	0.049	0.087	0.300	0.243	0.141	0.929
	(2.479)	(2.150)	(2.230)	(-0.452)	(1.781)	(1.978)	(0.191)	(0.302)	(1.189)	(0.687)	(0.042)	(0.680)
deforest	0.202	0.221	0.128	0.259	3.762**	1.580	0.818**	0.722**	0.595	0.027	3.636	-2.808
	(0.851)	(0.880)	(0.570)	(0.504)	(2.302)	(1.313)	(2.269)	(2.126)	(1.592)	(0.028)	(0.324)	(-1.074)
govern	1.649***	1.355**	1.364**	0.659	0.991	3.651	1.343	1.164	0.568	1.388	4.824	0.413
	(2.692)	(2.426)	(2.463)	(0.530)	(0.543)	(1.352)	(1.052)	(0.885)	(0.429)	(0.777)	(0.220)	(0.119)
lngdppc	-0.130	0.143	0.182	0.060	0.943	-1.944	0.210	0.303	0.430	0.405	-1.067	1.103
	(-0.336)	(0.408)	(0.504)	(0.103)	(1.397)	(-1.171)	(0.410)	(0.631)	(0.811)	(0.609)	(-0.092)	(0.478)
lnghgcom	-0.253						0.738*					
	(-0.664)						(2.003)					
lnch4		-0.590						0.886				
		(-1.443)						(1.106)				
lnn2o			-0.159						-0.206			
			(-0.665)						(-0.617)			
lnhfcs				0.402**						0.246		
				(1.994)						(1.049)		
lnpfcs					-1.148						0.290	
					(-1.252)						(0.157)	
lnsf6						1.680**						-0.183
						(2.303)						(-0.268)
χ^2	62.5	54.7	54.8	32.1	70.4	25.7						
R^2							0.617	0.604	0.599	0.704	0.950	0.826
Adjusted R^2							0.421	0.383	0.376	0.393	-0.058	0.393
P-values	0.000	0.000	0.000	0.043	0.000	0.176	0.000	0.000	0.000	0.000	-0.058	0.393
N	171	187	186	111	57	81	57	57	57	40	22	29

Of the six GHGs, the coefficients of hydrofluorocarbon, *lnhfcs*, are positive and significant at both stages at 1% and 5% at selection and allocation of mitigation finance commitment respectively (Table 3.7, c16 and c22) and at 5% at selection stage mitigation finance disbursement (Table 3.8, c28), whereas the coefficients of sulphur hexafluoride, *lnsf6*, are positive and significant only at the selection stage at both mitigation finance commitment and disbursement (Table 3.7, c18 and Table 3.8, c30). HFCs and SF_6 are two of the most destructive gases with the highest global warming potential (GWP). HPC-23, one of HFC's components, has GWP 11,700 times more powerful than CO_2 over a hundred-year period, and SF_6 has the greatest GWP and longest lifespan of all GHG. Some proxies, *lnch4* (c20), and *lnn2o* (c15), have a negative relationship with mitigation finance, potentially due to their high correlations – above 0.7 – with *lnco2*, whereas *lnhfcs* and *lnsf6* have lower correlations with *lnco2* (See Appendix 3.3). *lnghg* turns to be positive and significant at allocation stage of mitigation finance disbursement (c31) however it is only significant at 10%.

In Table 3.9, *rci*, indicating the trend of CO_2 intensity per unit of GDP, appears to be positive and significant in both selection (c37) and allocation (c38) stages at 1% and 5% respectively. The beta coefficient of *rci* is consistently positive and significant in mitigation finance disbursement at selection stage (c41). It shows that the more emissions per unit of GDP compared to the previous year, the higher the probability of a developing country being eligible for mitigation finance and the more mitigation finance it tends to receive. This unexpected finding shows that the increasing intensity of emissions of developing countries positively determines the distribution of mitigation finance in both the selection and the allocation stages. Some energy-intensive countries are making major efforts to improve their energy efficiency (Li & Wang, 2012). Reducing the energy used per unit of economic activity in large developing countries with high economic growth is expected to contribute to the large-scale reduction of global GHG emissions in both the short and the long term.

Table 3.9: Estimation results on mitigation finance for CO_2 intensity per unit of GDP and MPAs

	Commitment				Disbursement			
	rci		marine		rci		marine	
	Selection	Allocation	Selection	Allocation	Selection	Allocation	Selection	Allocation
	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)
lnco2	0.003	0.066	-0.174	-0.025	-0.391**	0.326*	-0.470***	-0.101
	(0.021)	(0.314)	(-1.286)	(-0.134)	(-2.337)	(1.667)	(-3.430)	(-0.570)
lnforest	0.144**	-0.060	0.127***	-0.039	0.205***	-0.058	0.161***	-0.042
	(2.492)	(-0.653)	(2.861)	(-0.533)	(3.116)	(-0.845)	(3.509)	(-0.720)
deforest	-0.087	0.349**	0.063	0.433***	0.103	0.132	0.193***	0.356***
	(-1.074)	(2.538)	(1.002)	(4.097)	(0.982)	(1.413)	(2.582)	(4.376)
govern	0.737**	0.720	0.547**	0.949***	0.899**	1.279***	0.570**	0.593**
	(2.106)	(1.634)	(2.294)	(3.213)	(2.453)	(3.406)	(2.359)	(2.401)
lngdppc	-0.333	-0.375	-0.380*	-0.492**	0.058	-0.741***	-0.130	-0.553**
	(-1.493)	(-1.514)	(-1.914)	(-1.982)	(0.238)	(-2.778)	(-0.679)	(-2.444)
lninfant	-0.066	-0.011	-0.197	-0.230	0.386	-0.278	-0.068	-0.599***
	(-0.238)	(-0.040)	(-0.917)	(-0.896)	(1.466)	(-1.062)	(-0.320)	(-2.667)
lnpop	0.514**	0.940***	0.730***	0.923***	0.977***	0.519**	1.025***	1.052***
	(2.455)	(3.580)	(4.164)	(3.857)	(4.433)	(2.011)	(5.788)	(4.512)
fdiinflow	-0.002	0.093**	0.010	0.060***	-0.003	-0.000	0.002	0.066***
	(-0.063)	(2.349)	(0.446)	(2.909)	(-0.078)	(-0.002)	(0.094)	(2.632)
democracy	0.052**	0.066**	0.047***	0.029	0.033	0.044*	0.047***	0.052***
	(2.242)	(2.021)	(2.745)	(1.218)	(1.445)	(1.710)	(2.702)	(2.687)
xcolony	0.032	0.232	-0.040	0.166	0.200	0.453*	0.187	0.330
	(0.123)	(0.847)	(-0.194)	(0.616)	(0.754)	(1.775)	(0.883)	(1.452)
rci	0.399***	0.239***			0.383***	0.015		
	(3.367)	(2.624)			(3.467)	(0.170)		
marine			0.024***	0.017**			0.023***	0.015**
			(2.986)	(2.164)			(2.830)	(2.110)
χ^2	151.4		215.8		167.9		231.1	
R^2		0.365		0.318		0.438		0.420
Adjusted R^2		0.328		0.290		0.403		0.395
P-values	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	567	366	865	503	567	343	865	484

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

A further consideration is necessary, as using *rci* and other emissions with high GWP may, perversely, incentivise industrial economies to emit higher quantity of emissions. This chapter shows that the developing countries with the highest emissions in terms of GWP are countries with industrial economies such as Brazil and Turkey. Using these parameters tends to deter such countries from controlling their emissions, as higher emissions increase their eligibility for mitigation finance. It also potentially excludes poorer and non-industrial countries from mitigating climate change (Ballesteros *et al*., 2010, pp. 273, 288).

As an additional proxy of carbon sinks, *marine* is positive and significant at 1% in both stages of mitigation finance commitment and disbursement (Table 3.9, c39 and c43). Developing countries with larger MPAs tend to be eligible for mitigation finance and also receive more mitigation finance. Donors seem to rely on the assumption that emissions can be reduced alongside or as a long-term by-product of protecting marine biodiversity, e.g. mangrove plantations which are forced to function as pollution mitigation zones (Wickramasinghe *et al.*, 2009).

The extent of their natural assets and the magnitude of their emissions and land-use problems determine the allocation of global mitigation finance to developing countries, and mitigation finance inflows depend on these countries' potential for reducing their emissions. This section shows how certain characteristics representing such potential, namely greenhouse gases with high GWP, increasing rates of CO_2 intensity per unit of GDP, high rates of deforestation and vast MPAs, influence the global distribution of mitigation finance, *ceteris paribus.*

3.7. Mitigation finance, poverty aid and overall ODA

This section contrasts the distribution of mitigation finance, poverty aid and overall ODA commitment in two stages. Several determinants affect the distribution of mitigation finance, poverty aid and overall ODA differently and some have similar influences on all categories. The discussion begins with the differences.

First, the relationship between overall ODA and *lnco2* is negative and significant at 1% (Table 3.10, c47). Poverty aid also has a negative relationship with *lnco2* although only statisitically significant at 1% (c45). CO_2 emission levels tend to have a negative effect on of overall ODA and poverty aid, indicating that ODA aimed mainly at alleviating poverty still largely benefits developing countries with lower emission levels.

Table 3.10. The determinants of overall ODA commitment

	Poverty aid		Overall ODA	
	Selection (45)	Allocation (46)	Selection (47)	Allocation (48)
lnco2	-0.249*	-0.011	-7.566***	-0.026
	(-1.667)	(-0.335)	(-5.130)	(-0.889)
lnforest	0.229***	-0.025	0.847***	0.001
	(5.183)	(-1.492)	(3.120)	(0.071)
deforest	0.230***	0.033	2.012***	0.087***
	(3.552)	(1.354)	(4.018)	(4.363)
govern	0.785***	0.272***	5.515***	0.409***
	(3.381)	(3.513)	(3.330)	(5.921)
lngdppc	-0.303	-0.479***	1.534***	-0.508***
	(-1.533)	(-8.946)	(2.849)	(-10.716)
lninfant	0.886***	0.069	10.579***	0.052
	(4.416)	(1.168)	(4.918)	(0.978)
lnpop	0.527***	0.514***	6.672***	0.538***
	(2.960)	(12.641)	(5.584)	(14.617)
fdiinflow	-0.014	0.023***	0.066	0.016***
	(-0.577)	(3.789)	(1.041)	(3.027)
democracy	0.040**	0.024***	-0.191**	0.022***
	(2.234)	(4.246)	(-2.270)	(4.093)
xcolony	-0.345	0.160***	-3.050***	0.165***
	(-1.606)	(2.654)	(-4.516)	(2.740)
χ^2	242.1		96.3	
R^2		0.609		0.623
Adjusted R^2		0.600		0.616
P-values	0.000	0.000	0.000	0.000
N	1146	870	1146	1059

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%, 5%, and 1% level respectively.

Secondly, the social variable (*lninfant*) is a positive determinant of poverty aid, significant at 1% indicating that social development is still a strong concern at the selection stage. It is insignificant at the allocation stage. A high level of corruption in poor countries often becomes a barrier for donors to provide more poverty aid (Gibson *et al.*, 2005, p. 87). There is lack of evidence on whether mitigation finance has a social development impact and seems to be in competition: e.g. reforestation projects may restrict the human rights and the livelihoods of indigenous communities (Larson, 2011).

Thirdly, ex-colony variable seems to be irrelevant determinant of mitigation finance, but it influences the allocation of poverty aid and overall ODA (c46, c48). Donors have flexibility to prioritise ex-colony when the objectives of the aid does not strongly rely on natural capacity of recipients like in the case of mitigation finance for mitigating emissions. Democratic environment is also an important condition for mitigation finance – positive and significant at 1%, but overall ODA is also allocated to non-democratic environment and there are increasing development activities in the fragile states and conflict zones (de Mesquita & Smith, 2013; Zürcher, 2012).

A few determinants affect mitigation finance and overall ODA provisions differently, but carbon sinks (*lnforest*), governance and population determine both in a similar manner. First, *lnforest* is significant and a strong determinant of all aid categories (Table 3.5, c1 and Table 3.10, c45 and c47). There is a strong association between forests or a large area of natural sink and ODA. Potentially many development activities take place in rich-forested developing countries due to a close relationship between poverty, livelihood and access to environmental resources (Kamanga *et al.*, 2009; Naughton-Treves *et al.*, 2011). Third, the relationship between infant mortality (*lninfant*) and overall ODA is positive and significant at 1%, indicating that poverty and social development are still major determinants of overall ODA allocation. The magnitude of its beta coefficient 10.579 is very high compared to the coefficients from other categories indicating there is still a strong commitment of ODA to tackle global social problems.

The coefficients of *govern* are consistently significant at 1% in both mitigation finance and overall ODA (compare Table 3.10, c45, c47 and Table 3.5, c1). Although *govern* is positive and significant in all aid categories, it is a strict gatekeeper of overall ODA's eligibility criteria and mitigation finance's allocation criteria. The beta coefficient of overall ODA is larger in selection stage and otherwise for mitigation finance. Surprisingly, in general, qualifying for general ODA demands better governance than qualifying for mitigation finance. While in mitigation finance, governance is complementary to objective parameters of mitigation finance.

There is a consistent significantly negative relationship with income per capita and a significantly positive relationship with population in all categories. It appears that recipients with lower income and larger populations are awarded both categories of aid, indicating donors' effort to promote equity and equal distribution by providing aid to poorer recipients, although in the case of mitigation finance, there is strong evidence of a small-country bias – the coefficient of *lnpop* is less than 1 (Table 3.5, c1 and c5) – showing that in terms of aid per capita, countries with smaller populations tend to receive more mitigation finance. FDI inflow is a positive determinant for all aid categories at the allocation stage (Table 3.5, c5 and Table 3.10, c46 and c48), showing that regardless of the aid category, an open economy is an attractive characteristic to have a large investment perhaps because of the possibility to have economic co-benefits such as conditional aid spending on procurements to be made from specified donor-country companies.

There are some differences between poverty aid and overall aid that may indicate how increasing the proportion of mitigation finance in total aid may have influenced the allocation of aid more broadly. The sensitivity of some climate-related variables is stronger in total aid. The CO_2 emissions variable (*lnco2*) is negative and significant at the selection stage for both aid categories (Table 3.10, c45 & c47). However, the coefficient of *lnco2* is much stronger at the selection stage of overall aid than in that of poverty aid. Improving the economy of non-industrial countries is still a major general concern of aid. This emission variable may have less relevance in the case of poverty aid, whose allocation is determined by social development more than pollutant factors.

The coefficient of *lnforest* in the selection stage is four time more sensitive in the case of overall aid (c47) than in that of poverty aid (c45), and the coefficient of *deforest* behaves in a similar way. While *deforest* is insignificant at the selection stage for poverty aid, it is strongly significant in the case of overall aid (c48). There is a tendency for the allocation of overall aid to be influenced by environmental problems such as deforestation. It is also worth noting that the coefficient of governance (*govern*) in poverty aid is weaker than that in overall aid. The coefficient of *govern* at the selection stage for poverty aid (c45) is 7.8 times smaller than that at the same stage of overall aid (c47). It is likely that poverty aid is allocated to countries with weak governance, such as fragile states where fundamental poverty aid is still a major requirement.

The economic and social development variables of the two aid categories are also slightly different. The coefficient of income per capita (*lngdppc*) is positive at the selection stage for overall aid (c47) while it is insignificant in the case of poverty aid (c45). The positive relationship between overall aid and income per capita contradicts ODA's intended objective of developing the economies of poorer countries and regions. It is understandable that the coefficient of *lngdppc* for poverty aid is insignificant when this particular category of aid might be allocated based on the status of the developing country's social development, as represented by the infant mortality variable (*lninfant*), which is positive and significant (c45). However, the sensitivity of this variable is much higher at the selection stage for overall aid (c47), showi ng shows that social development is still one of the major determinants of overall aid allocation, while other factors such as global environmental problems influence how such aid is allocated.

3.8. Developing countries' global environmental commitments

This section discusses which global atmospheric pollution treaties to which developing countries are either parties or signatories influence the allocation of mitigation finance.

Developing countries' commitment to reducing their emissions is one of the key requirements for the success of international negotiations on climate change and of mitigating emissions globally. There is an urgent need for serious commitment, ideally to legally-binding emission targets, by not only developed but also developing countries, particularly China, India, Brazil, Mexico and other economies in transition (Chandler *et al.*, 2002). Currently developing countries are tending to postpone their commitment to legally-binding emission targets because they fear that it will limit their economic growth (Bodansky, 2010a, p. 112). Another reason is an increasing demand calling for global environmental justice, as climate change is known to have been caused by rich nations' historical industrial economic development and to affect severely poor and vulnerable in developing countries (Okereke & Schroeder, 2009).

At COP15 some developing countries committed to non-legally-binding targets measured against different factors. Brazil, Indonesia, Mexico, South Africa and South Korea committed to reducing their emissions against the level of business-as-usual (BAU) set by IPCC First Assessment Report (1990) by 36.1%-38.9%, 26%, 30%, 34% and 30% respectively, and China and India committed to reducing their carbon intensity by 40%-45% and 20%-25% respectively compared to their 2005 levels (UNFCCC, 2011b). However, there are neither financial nor legal consequences if they fail to fulfil these commitments. The uncertainty surrounding developing countries' commitment continues to limit the prospect of a new Post-Kyoto agreement with legally-binding targets for all countries.

Sandler (2004) explains that international negotiations as a form of global collective action that aims to mitigate two different types of atmospheric pollution, may have different outcomes. The world has been successful with treaties curbing stratospheric ozone-depleting substances such as chlorofluorocarbons (CFCs) and bromide-based substances. However, little has been achieved towards mitigating GHG emissions. He argues that the success of the world to curb the ozone-depleting substances is due to the fact that fewer countries produce these substances than other GHGs, making the arrangement of an agreement less complicated.

Secondly, ultra-violet radiation resulting from the increase in these ozone-depleting substances has an equal impact on all humans on earth, whereas the negative impacts of climate change are global but are not equally distributed. Some countries can benefit from increasing temperatures, for instance through bigger and faster crop yields. Chapter 5 explains the different outcomes of global collective action to mitigate global atmospheric pollutions in detail.

This section tests five global atmospheric pollution agreements:

(1) the 1985 Vienna Convention for the Protection of the Ozone Layer
(2) the 1990 London Amendment to the Montreal Protocol to gradually remove 15 CFCs by up to 85% compared to 1986 levels and eventually eliminate them; increased cuts to the emission of three halons, carbon

tetrachloride and methyl chloroform; and non-binding cuts to hydrochlorofluorocarbons (HCFCs)

(3) the 1992 Copenhagen Amendment to the Montreal Protocol to accelerate the phasing out of 15 CFCs (by 1996), 3 halons, carbon tetrachloride and methyl chloroform; removing HCFC emissions and adding hydrobromofluorocarbons (HBFCs) and methyl bromide to the list of controlled substances
(4) the 1992 Rio Conventions
(5) the 1997 Kyoto Protocol.

The first three agreements crucially support the successful elimination of ozone-depleting substances (Sandler, 2004, p. 216) and the latter two ambitiously aim to mitigate all GHG emissions. According to Sandler there are diverging outcomes of mitigating ozone depleting substances and mitigating GHG emissions and thus two different responses which differentiate the first three agreements from the Rio Conventions and the Kyoto Protocol. The hypothesis is that mitigation finance responds to the latter two more than to the first three agreements, which may influence mitigation finance inflows as commitment to these agreements shows the persistence of a country's environmental commitment in mitigating CFCs hydrochlorofluorocarbons (HCFCs) and hydrobromochloroflu- orocarbons (HBFCs), which have been successfully mitigated. These substance were phasing out and replaced by HFCs.

Developing countries' commitment to each of these five global atmospheric pollutant agreements is coded with '0' for no participation, '1' for a signatory and '2' for a party, the highest level of commitment. In this study the total score for the five agreements is called the 'climate treaty index'. To avoid multicollinearity, this index is tested separately from the first model, which includes five variables representing five individual treaties. The status of each country on each agreement is obtained from NASA's Environmental Treaties and Resource Indicators (ENTRI) compiled by its Socioeconomic Data and Application Centre (SEDAC), which is hosted by the Center for International Earth Science Information Network at Colombia University (CIESIN-SEDAC, 2011).

In Table 3.11, all five treaty variables are tested simultaneously with all the main variables listed in Eq. (1). As expected, developing countries being parties or signatories to agreements prior to the Rio Conventions does not significantly influence their being selected to receive, mitigation finance. The coefficients of these treaties are not significant in either its commitment or the disbursement of mitigation finance (Table 3.11, c49, c51, c53, c55). Interestingly, the other two treaties – the Rio Conventions and the Kyoto Protocol – significantly influence the allocation of mitigation finance in opposing ways. The coefficients of the Rio Conventions are negative in the allocation stage for both mitigation finance commitment and disbursement (c51, c55).

Table 3.11: Mitigation finance inflows and developing countries' environmental commitment

	Commitment				Disbursement			
	Selection		Allocation		Selection		Allocation	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	(49)	(50)	(51)	(52)	(53)	(54)	(55)	(56)
lnco2	0.109	0.057	0.136	0.092	-0.057	-0.091	0.292**	0.285**
	(1.060)	(0.589)	(1.006)	(0.688)	(-0.549)	(-0.922)	(2.277)	(2.211)
lnforest	0.154***	0.169***	0.043	0.049	0.230***	0.239***	0.040	0.048
	(3.835)	(4.274)	(0.641)	(0.749)	(5.338)	(5.694)	(0.753)	(0.948)
deforest	-0.026	-0.019	0.291***	0.298***	0.073	0.063	0.211***	0.254***
	(-0.440)	(-0.338)	(3.229)	(3.296)	(1.112)	(0.969)	(2.939)	(3.469)
govern	0.819***	0.775***	1.187***	1.136***	0.948***	0.898***	1.130***	1.109***
	(3.664)	(3.523)	(4.111)	(3.985)	(4.100)	(3.963)	(5.020)	(4.879)
lngdppc	-0.415**	-0.383**	-0.644***	-0.499**	-0.257	-0.217	-0.921***	-0.785***
	(-2.547)	(-2.449)	(-2.972)	(-2.440)	(-1.568)	(-1.391)	(-4.917)	(-4.175)
lninfant	0.155	0.080	-0.162	-0.041	0.296	0.251	-0.430**	-0.297
	(0.827)	(0.432)	(-0.635)	(-0.166)	(1.582)	(1.357)	(-2.024)	(-1.436)
lnpop	0.368***	0.386***	0.579***	0.675***	0.455***	0.483***	0.418***	0.447***
	(2.788)	(3.029)	(3.516)	(4.058)	(3.526)	(3.840)	(2.604)	(2.730)
fdiinflow	0.022	0.020	0.039**	0.050***	0.015	0.015	-0.000	0.003
	(1.109)	(0.935)	(2.044)	(2.732)	(0.896)	(0.867)	(-0.022)	(0.130)
democracy	0.027*	0.034**	0.003	0.004	0.019	0.021	0.019	0.019
	(1.780)	(2.345)	(0.149)	(0.193)	(1.221)	(1.441)	(1.097)	(1.087)
xcolony	-0.046	-0.137	0.073	-0.045	-0.021	-0.072	0.087	0.024
	(-0.258)	(-0.793)	(0.296)	(-0.192)	(-0.111)	(-0.404)	(0.414)	(0.115)
ozonelayer1985	0.003		0.307		0.209		-0.169	
	(0.021)		(1.256)		(1.363)		(-0.744)	
amendmontrealpro	0.016		0.254		0.121		0.132	
tlondon90	(0.144)		(1.610)		(1.035)		(1.018)	
amendmontrealpro	0.025		-0.172		-0.048		0.018	
tcopenhag92	(0.240)		(-1.318)		(-0.445)		(0.168)	
rioconventions92	0.303		-0.887***		0.116		-1.044***	
	(0.921)		(-2.640)		(0.380)		(-3.793)	
kyotoprotocol97	0.558***		0.052		0.273*		0.057	
	(3.699)		(0.251)		(1.754)		(0.357)	
climatetreatyindex		0.082**		0.046		0.088**		0.003
		(2.015)		(0.771)		(2.054)		(0.063)
χ^2	269.9	260.6			320.2	302.3		
R^2			0.281	0.271			0.360	0.346
Adjusted R^2			0.253	0.247			0.334	0.324
P-values	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	1094	1094	638	638	1094	1094	608	608

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%, 5%, and 1% level respectively.

In contrast, commitment to the Kyoto Protocol, the latest and most important climate treaty, appears to be an important factor for receiving mitigation finance. Developing countries with this commitment status tend to be selected as recipients, although those selected do not necessarily receive more mitigation finance (c51, c55). The coefficient *kyotoprotocol97* is positive and significant at 1% (c49). The positive relationship is also stable in the disbursement of mitigation finance (c53). It is possible that developing countries' participation as either signatories or parties to the Kyoto Protocol demonstrates their commitment to involve in solving global environmental problems. Hence, donors appreciate their commitment by providing mitigation finance to fund climate projects in these environmentally committed countries.

The coefficient *kyotoprotocol97* (0.558) is almost sevenfold that of *climatetreatyindex* (0.082) – statistically significant at 1% and 5% respectively - indicating that being a party to the Kyoto Protocol has a greater impact on the likelihood of a developing country qualifying for mitigation finance than its overall environmental commitment to international agreements related to global atmospheric pollutant problem.

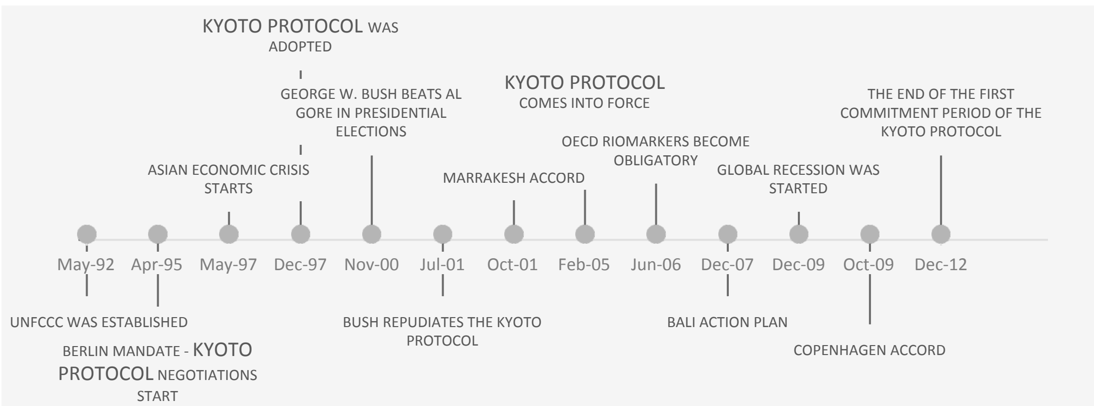
3.9. Mitigation finance, poverty aid and ODA in different periods of the Kyoto Protocol

This section compares the relative influence of significant determinants of mitigation finance and ODA allocation before (1998-2004) and after (2005-2010), when the Kyoto Protocol came into force, similar to Schraeder *et al.*'s (1998) retrospective aid study contrasting donors' political interests during and after the Cold War. Schraeder *et al.* (1998) find that US foreign aid policy was influenced by strategic and ideological interests related to the Cold War;

developing countries that have made an security alliance agreement with the US tend to receive US's aid.

The focus of analysis of this section is to compare the magnitude of the coefficients and the statistical significance of the determinants of the three aid categories in the two periods (see the timeline of the Kyoto Protocol in Figure 3.8). The comparative analysis of the three aid categories are performed using an identical period of observation. In the case of poverty aid and overall ODA, the period may not be related to any relevant event, but these two categories are set identically to the period of observation of mitigation finance to identify whether climate-related determinants influenced the allocation of overall ODA in the similar manner as the allocation of mitigation finance in the same time frame. The analysis of overall ODA is extended to before the adoption of the Kyoto Protocol (1990-1997). The intention is to investigate whether climate-related variables affected the allocation of overall ODA before the adoption of the Protocol in 1997.

Figure 3.8: Important events related to international negotiations on climate change



It is possible that the donors have considered their financial contribution to resolving climate change problems differently over time and also weighted each determinant of mitigation finance allocation before and since the Kyoto Protocol came into force differently. One possible explanation for this is the periods of optimism and pessimism during the formation of a global climate change regime via international meetings and negotiations (Carpenter, 2001; Pettenger, 2013). The level of the negotiators' confidence in the plenary may have influenced the donors' perceptions of how much money they should invest in mitigating global emissions and the determinants they used may also have changed as a result of the Kyoto Protocol's geopolitical pressure to reduce emissions in the donors' home countries.

In this section important global events relevant to climate change negotiations are discussed together with the estimation results. These events may influence global policy concerned with the provision and allocation of mitigation finance. The discussion starts with mitigation finance commitment, which is then compared to mitigation finance disbursement.

3.9.1. Pre-Kyoto Protocol adoption (1991-97)

Before the adoption of the Kyoto Protocol in 1997, several relevant and important events (see Figure 3.8) had an impact on international climate change negotiations and broader development aid policies. The Rio Conventions in 1992 resulted in the establishment of the UNFCCC and the Rio Marker coding system (as used in this thesis).

In the early 1990s, some Asian countries, notably South Korea, China, India and Indonesia, experienced economic booms. Alesina and Dollar (2000) argue that these countries' good policy environments accelerate development aid contributing to this success. The estimation shown in Table 3.12 (c57) supports this argument. In the period 1991-1997, governance (*govern*), population (*lnpop*), income per capita (*lngdppc*) and democracy (*democracy*) were major determinants of the allocation of overall ODA – statistically significant at 1% and 5%. This indicates that recipients with better governance, lower income per capita, larger populations and more democratic tended to receive more ODA inflows, *ceteris paribus*. There is lack of attention to the social development parameter *lninfant*, which is positive but insignificant. Democracy was aligned with development agenda during that era that promotes market liberalisation and international trade (Kremer *et al.*, 2009).

Table 3.12: Allocation of mitigation finance, poverty aid and overall ODA commitment before and after the Kyoto Protocol came into force

Period	1991-1997	1998-2004			2005-2010		
	Overall ODA (57)	Mitigation finance (58)	Poverty aid (59)	Overall ODA (60)	Mitigation finance (61)	Poverty aid (62)	Overall ODA (63)
lnco2	0.101	-0.019	-0.028	-0.028	0.160	-0.060	-0.065
	(1.190)	(-0.095)	(-0.576)	(-0.643)	(0.973)	(-1.301)	(-1.519)
lnforest	-0.038	0.155	-0.041	0.022	0.026	-0.053**	-0.002
	(-0.929)	(1.237)	(-1.402)	(1.151)	(0.372)	(-2.215)	(-0.117)
deforest	0.146*	0.377**	0.010	0.112***	0.275***	0.029	0.057**
	(1.727)	(2.087)	(0.214)	(3.828)	(2.797)	(0.776)	(2.085)
govern	0.496***	1.147**	0.239**	0.462***	1.170***	0.094	0.336***
	(2.882)	(2.439)	(2.017)	(5.607)	(3.613)	(0.767)	(3.268)
lngdppc	-0.447**	-0.458	-0.432***	-0.514***	-0.596**	-0.473***	-0.443***
	(-2.595)	(-1.320)	(-4.858)	(-7.594)	(-2.509)	(-6.040)	(-6.373)
lninfant	0.262	0.078	0.226**	0.038	-0.194	0.036	0.090
	(1.149)	(0.187)	(2.094)	(0.462)	(-0.669)	(0.406)	(1.328)
lnpop	0.388***	0.553**	0.488***	0.509***	0.719***	0.613***	0.608***
	(3.873)	(2.096)	(8.130)	(9.636)	(3.618)	(10.630)	(11.467)
fdiinflow	-0.006	0.026	0.001	0.003	0.060**	0.037***	0.035***
	(-1.494)	(1.261)	(0.141)	(0.817)	(2.143)	(3.722)	(5.071)
democracy	0.032**	-0.034	0.010	0.009	0.028	0.031***	0.028***
	(2.011)	(-0.977)	(1.034)	(1.338)	(1.110)	(3.427)	(3.655)
xcolony	0.232	-0.062	0.010	0.067	-0.116	0.216**	0.159**
	(1.111)	(-0.150)	(0.098)	(0.781)	(-0.399)	(2.541)	(1.969)
R^2	0.536	0.217	0.657	0.611	0.302	0.631	0.640
Adjusted R^2	0.487	0.169	0.636	0.600	0.279	0.618	0.630
P-values	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	105	244	244	531	425	425	550

Note: Heteroscedasticity-corrected t-statistics in parentheses. Time dummies included in all regressions. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

Interestingly deforestation variable influenced overall ODA before the negotiation of Kyoto Protocol was ratified in 1997 – *deforest* is positive and statistically significant at 10%, *ceteris paribus*. It is possible that in this era development aid was allocated to poor developing countries in the tropical forested regions to promote international trade of forest products.

Prior to the adoption of the Kyoto Protocol the focus of ODA was mainly on improving the economic growth of low-income recipient countries with good governance via measures such as structural adjustment, market liberalisation and trade (Kremer *et al.*, 2009). It is often claimed that the rapid economic growth of these countries is the result of positive interaction between aid practices and good institutional and policy performance (Burnside & Dollar, 2004; Burnside & Dollar, 1997). There is no evidence that climate-related variables have a significant influence on the allocation of overall ODA. During this period the international climate activity was still in its infancy and few studies explored the relationship between climate change and development activities. The main studies during this period are the First Assessment and Working Group IPCC reports in 1990 and its three supplementary reports in 1992 (IPCC, 1990, 1992a, 1992b, 1992c). The report of Working Group III highlighting the economic and social dimensions of climate change was released in 1995 (IPCC, 1995).

3.9.2. Post-Kyoto Protocol adoption (1998-2004)

Following the adoption of the Kyoto Protocol in 1997 there was a transitional period when the response to climate change was erratically mainstreamed into global development policies and ODA. However, various political and economic events interchangeably championed and challenged this process. The adoption of the Kyoto Protocol coincided with the onset of Asian economic crisis and the 2000 US election – won by Bush and lost by Al Gore, an environmentalist - spread pessimism throughout the COP plenary.

These events discouraged climate practitioners and keen donors to some extent from continuing their support for the resolution of global climate change problems, and partly account for the 2000 shortfall in mitigation finance commitment from overall ODA (see the decreasing trend in 2000 in Figure 2.2). Nevertheless, as the date for the Kyoto Protocol to come into force approached, Japan's international diplomacy actively worked to persuade more countries to ratify it including negotiating with Russia, a country with a large economic and political capacity, whose position became crucial to the fulfilment of the second condition (MOFA, 2004). On November 18 2004, 90 days before the Kyoto Protocol came into effect, Russia finally ratified it, although the US and Australia did not.

In 1998-2004 there is no obvious evidence that allocation of mitigation finance was strong determined by the objectives of mitigation finance to reduce global emissions. It was still largely influenced by the determinants of overall ODA, namely governance and population with a growing interest in recipient countries with higher deforestation rates (Table 3.12, c58). The coefficient of *lnforest* of mitigation finance is greater than the 1991-98 overall ODA's (c57). In 1998-2004, the coefficients of governance (*govern*) in the case of mitigation finance, poverty aid, overall ODA are all positive and significant at 5% and 1%. As the coefficient of *govern* in the case of mitigation finance (c58) is larger than in the case of poverty aid (c59) and overall ODA (c60), for every increase of one average point on the government index, recipients receive a larger increase in mitigation finance than in poverty or overall ODA, indicating greater appreciation of recipient countries' policy environments where mitigation finance was concerned.

There is no evidence that from 1998-2004 climate-change-related variables influenced the allocation of mitigation finance – *lnco2* and *lnforest* are insignificant (c58). Possibly much attention turned to persuading as many as countries as possible to ratify the Protocol. In this uncertain circumstance, the overall strategy for allocating mitigation finance reflects that of overall ODA. This unsettled period of political uncertainty and lack of knowledge about favourable conditions for effective mitigation finance allocation may maintain donors tended to continue relying on the existing ODA determinants for their allocation of mitigation finance.

3.9.3. During the implementation of the Kyoto Protocol (2005-2010)

In the years after the Kyoto Protocol became legally binding for which mitigation finance data are available, i.e. 2005-2010, there were academic and policy-related movements to promote more active global responses to climate change. In 2007 the influential and contentious Stern report on the economics of climate change was released at the same time as the IPCC's fourth assessment report (IPCC, 2007; Stern, 2008a). These events promoted a more active global response to climate change and are likely to have contributed to increased disbursement of and commitment to mitigation finance from 2006 onwards (see the increasing trend after 2006 in Figure 2.2). Donors started implementing national carbon mitigation policies and there were real intentions to also begin working to mitigate emissions in developing countries. From 2005, donors significantly increased their disbursement of actual mitigation finance, which explains the narrowing gap between commitment and disbursement in 2007-2008.

Compared to earlier periods in the implementation of the Kyoto Protocol, there is stronger evidence that mitigation finance variables influenced the allocation of mitigation finance. In c61, carbon sinks (*lnforest*) and forest areas (*deforest*) are significant. Other previously significant variables such as governance, income per capita and FDI inflow, remain significant and stable. It seems that in this period serious attention was given to recipient countries with larger areas of forest. The greater their forested area, the more funding these countries received, *ceteris paribus*. The estimations of poverty aid and overall ODA in c62 and c63 show that recipients with a higher level of democracy and with ex-colonial status are rewarded with more poverty aid and overall ODA - significant at 1%. However, these characteristics are not significant determinants of mitigation finance. Mitigation finance, with its specific targets, is effective when the recipients have natural capacity to mitigate emissions, therefore the two variables representing political interests are less applicable in the allocation of mitigation finance.

In this period, FDI inflow, income per capita and population turn to be strong determinants of all three aid categories – statistically significant at 5% and 1% (c61-c63). There is an indication that a developing country whose GDP largely depends on foreign investment tends to receive mitigation finance. Foreign investment related to climate change sectors such as renewable and alternative energy and their accompanying technologies may account for donors’ access to international investment opportunities offered by the recipient countries. An increasing intensity of collaboration between public and private sectors in financing development explains the importance of FDI inflow as a determinant of aid allocation in both categories after 2005 (DECC, 2013; Pattberg & Stripple, 2008; Selaya & Sunesen, 2012). In this period, large developing recipient countries with large populations and lower income per capita tended to receive aid in all categories. If this is the case, a small country bias – with the coefficient of *lnpop* smaller than 1 – characterises all three aid categories. In general a small country tends to receive more aid per capita than a large country.

3.9.4. Mitigation finance, poverty aid and overall ODA disbursement in the Kyoto Protocol periods

Mitigation finance disbursement reflects mitigation finance commitment after several adjustments such as donor's budget approval and the recipient's monetary policies to minimise harm caused by a large inflow of foreign currency (Collier & Goderis, 2009). Hence disbursement inflow does not fully represent donors' initial interests.

The results from disbursement data in the two periods of the Kyoto Protocol show evidence that, only in the period of 1998-2004 CO_2 emissions (*lnco2*) is a significant determinant of mitigation finance – positive and significant at 5% (Table 3.13, c65). During the negotiations on the Kyoto Protocol (1998-2004) donors disbursed a larger amount of mitigation finance to recipients with higher emissions. In the same period, governance (*govern*) turns to be an insignificant determinant of mitigation finance (c65). Donors become less stringent to use governance and recipients' performance as one of the criteria of a recipient to get more mitigation finance.

Table 3.13: The allocation stage of mitigation finance, poverty aid and overall ODA disbursement before and after the Kyoto Protocol came into force in 2005

Period	1991-1997	1998-2004			2005-2010		
	Overall ODA (64)	Mitigation finance (65)	Poverty aid (66)	Overall ODA (67)	Mitigation finance (68)	Poverty aid (69)	Overall ODA (70)
Regressors							
lnco2	-0.043	0.516**	0.052	0.069	0.223	-0.039	-0.041
	(-0.439)	(2.549)	(0.881)	(1.611)	(1.529)	(-0.811)	(-0.904)
lnforest	-0.016	0.068	-0.036	-0.022	0.044	-0.041*	0.005
	(-0.355)	(0.839)	(-1.068)	(-1.216)	(0.709)	(-1.958)	(0.286)
deforest	0.099	0.354***	-0.008	0.094***	0.183**	0.000	0.021
	(1.284)	(3.373)	(-0.158)	(3.319)	(2.078)	(0.007)	(0.654)
govern	0.341**	0.453	0.113	0.462***	1.492***	0.105	0.349***
	(2.022)	(1.525)	(0.703)	(5.497)	(5.320)	(0.900)	(3.521)
lngdppc	-0.400**	-0.749***	-0.621***	-0.624***	-0.909***	-0.527***	-0.536***
	(-2.381)	(-2.965)	(-6.787)	(-8.941)	(-4.075)	(-6.901)	(-7.930)
lninfant	0.036	0.219	0.175	0.116	-0.583**	-0.006	-0.006
	(0.153)	(0.910)	(1.554)	(1.468)	(-2.197)	(-0.068)	(-0.082)
lnpop	0.473***	-0.064	0.327***	0.354***	0.622***	0.493***	0.509***
	(4.017)	(-0.251)	(4.927)	(6.975)	(3.323)	(8.756)	(9.132)
fdiinflow	-0.001	-0.038	-0.000	-0.000	0.023	0.038***	0.037***
	(-0.349)	(-1.424)	(-0.034)	(-0.100)	(0.983)	(3.572)	(4.989)
democracy	0.018	0.008	-0.000	-0.000	0.023	0.012	0.010
	(1.113)	(0.333)	(-0.015)	(-0.076)	(1.012)	(1.430)	(1.325)
xcolony	0.210	-0.077	0.009	0.040	-0.025	0.148*	0.116
	(0.968)	(-0.229)	(0.079)	(0.463)	(-0.100)	(1.741)	(1.386)
R^2	0.527	0.356	0.597	0.564	0.373	0.597	0.607
Adjusted R^2	0.475	0.310	0.572	0.552	0.351	0.583	0.596
P-values	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	102	208	242	522	430	417	542

Note: Heteroscedasticity-corrected t-statistics in parentheses. Time dummies included in all regressions. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

Of all the variables tested in this chapter, income per capita (*lngdppc*) appears to be the only one that consistently influences mitigation finance across different periods and categories (Table 3.13, c64-c70). A negative relationship between the actual allocation of mitigation finance and income per capita aligns with the hypothesis set in this chapter, indicating that mitigation finance, like poverty aid and ODA overall, carries a mission to support and promote poor developing countries' economic development and welfare. Mitigation finance, with its environmental benefits that are shared with all countries on Earth, still has a strong developmental economic feature, showing that its allocation adheres to the main objectives of ODA with the additional expectation that it also has a positive effect on our planet.

3.10. Conclusions

Developing countries with the potential for emission mitigation on a large scale, due to the size of their environmental assets such as forest areas or marine protected areas or their emission problems, tend to be selected as recipients of climate mitigation finance. Those with higher CO_2 intensity per unit of GDP, larger carbon sink, lower per capita GDP and good governance tend to receive more mitigation finance. There is a delay in using CO_2 emissions and in decision-making about allocation until the actual funding is disbursed. While the allocation of mitigation finance tends to be higher to developing countries with lower per capita GDP, there is no strong evidence that it is also higher to countries with higher infant mortality. However the larger part of ODA is still given as poverty aid, which tends to be allocated to developing countries with low CO_2 emissions, conceivably to avoid diverting ODA from poorer developing countries.

However, the risk of diverting overall ODA from addressing social development is unavoidable if the share of mitigation finance in climate finance and in overall ODA continues to escalate. One option, making climate finance additional to the 0.7% of ODA/GNI target, would safeguard against such a diversion. Global GHG emissions will continue to increase if mitigation finance continues to reward an increase in CO_2 intensity per unit of GDP and larger GHG emissions. The allocation of mitigation finance must incentivise and reward emission reduction and/or decreased CO_2 intensity per unit of GDP even though the resulting reduction may be small and apparently insignificant.

There is strong evidence that developing countries' commitment to the Kyoto Protocol is an important criterion for receiving mitigation finance and that the effects of the natural characteristics of developing countries on the probability of receiving mitigation finance vary according to the results of dynamic interactions between policymaking and research dissemination during international climate change negotiations.

The Kyoto Protocol is a hallmark of not only donors' but also developing countries' commitment to mitigating global pollution. The commitment of developing countries to the Kyoto Protocol qualifies them to receive mitigation finance, while their status and commitment to previous treaties related to the protection of the ozone layer are insignificant in the allocation of mitigation finance. Before the implementation of the Kyoto Protocol mitigation finance allocation strongly reflected overall ODA allocation, while during its implementation climate-related determinants influenced the allocation of mitigation finance, although there was inconsistent application of mitigation finance determinants between its commitment and disbursement. This inconsistency negatively affects the motivation of recipients that are serious about reducing their national emissions but discouraged by the reallocation of actual mitigation finance to larger polluting countries.

This chapter has extensively examined and discussed the global allocation of mitigation finance. The next chapter empirically analyses the specificities of mitigation finance allocation across major mitigation finance donors and instruments of mitigation finance.

APPENDIX 3.1: LIST OF DEVELOPING COUNTRIES

Developing countries	ISO3 Code	Aggregate mitigation finance				Overall ODA			
		Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)	Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)
India	IND	1	8624.00	23.49%	0.055	2	54712.54	4.20%	0.002
Indonesia	IDN	2	5683.83	15.48%	0.024	3	47472.7	3.65%	0.001
China	CHN	3	4615.33	12.57%	0.016	7	39372.88	3.03%	0.001
Vietnam	VNM	4	1667.74	4.54%	0.002	4	44183.58	3.40%	0.001
Thailand	THA	5	1621.64	4.42%	0.002	37	11139.46	0.86%	0.000
Turkey	TUR	6	1442.13	3.93%	0.002	24	16016.61	1.23%	0.000
Egypt	EGY	7	1296.24	3.53%	0.001	14	25447.55	1.96%	0.000
Kenya	KEN	8	1031.32	2.81%	0.001	18	20586.3	1.58%	0.000
Brazil	BRA	9	861.63	2.35%	0.001	54	6748.49	0.52%	0.000
Bangladesh	BGD	10	708.57	1.93%	0.000	9	34098.4	2.62%	0.001
Morocco	MAR	11	636.14	1.73%	0.000	19	19001.21	1.46%	0.000
Tunisia	TUN	12	632.90	1.72%	0.000	46	9382.02	0.72%	0.000
Sri Lanka	LKA	13	581.96	1.59%	0.000	26	14189.25	1.09%	0.000
Pakistan	PAK	14	456.48	1.24%	0.000	6	43711.43	3.36%	0.001
Mexico	MEX	15	344.68	0.94%	0.000	65	5141.35	0.40%	0.000
Azerbaijan	AZE	16	321.84	0.88%	0.000	73	4440.9	0.34%	0.000
Nepal	NPL	17	321.61	0.88%	0.000	42	10132.56	0.78%	0.000
Uzbekistan	UZB	18	318.06	0.87%	0.000	78	4060.37	0.31%	0.000
Tanzania	TZA	19	288.28	0.79%	0.000	10	33119.57	2.55%	0.001
Guyana	GUY	20	270.49	0.74%	0.000	94	2505.39	0.19%	0.000
Paraguay	PRY	21	254.24	0.69%	0.000	96	2376.36	0.18%	0.000

Developing countries	ISO3 Code	Aggregate mitigation finance				Overall ODA			
		Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)	Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)
Iraq	IRQ	22	240.50	0.66%	0.000	1	79080.42	6.08%	0.004
Mauritius	MUS	23	232.52	0.63%	0.000	106	1661.43	0.13%	0.000
South Africa	ZAF	24	227.07	0.62%	0.000	31	12637.82	0.97%	0.000
Philippines	PHL	25	214.29	0.58%	0.000	23	16207.77	1.25%	0.000
Armenia	ARM	26	176.25	0.48%	0.000	66	5054.07	0.39%	0.000
Peru	PER	27	168.32	0.46%	0.000	43	9682.86	0.74%	0.000
Jordan	JOR	28	165.16	0.45%	0.000	35	12028.86	0.92%	0.000
Mozambique	MOZ	29	163.90	0.45%	0.000	13	25571.26	1.96%	0.000
Uganda	UGA	30	160.43	0.44%	0.000	15	21482.51	1.65%	0.000
Serbia	SRB	31	158.06	0.43%	0.000	17	20738.2	1.59%	0.000
Ukraine	UKR	32	142.36	0.39%	0.000	82	3814.03	0.29%	0.000
Chile	CHL	33	139.57	0.38%	0.000	104	1797	0.14%	0.000
Bosnia-Herzegovina	BIH	34	137.07	0.37%	0.000	40	10730.6	0.82%	0.000
Mongolia	MNG	35	135.22	0.37%	0.000	67	4925.69	0.38%	0.000
Cameroon	CMR	36	113.30	0.31%	0.000	25	15847.46	1.22%	0.000
Ethiopia	ETH	37	110.18	0.30%	0.000	11	32975.17	2.53%	0.001
Nicaragua	NIC	38	107.90	0.29%	0.000	30	13318.72	1.02%	0.000
Burkina Faso	BFA	39	107.50	0.29%	0.000	34	12115.41	0.93%	0.000
Zambia	ZMB	40	90.24	0.25%	0.000	22	17280.99	1.33%	0.000
Croatia	HRV	41	76.82	0.21%	0.000	88	3015.29	0.23%	0.000
Bolivia	BOL	42	71.65	0.20%	0.000	28	13858.98	1.06%	0.000
Congo, Dem. Rep.	ZAR	43	70.17	0.19%	0.000	12	30014.61	2.31%	0.001
Afghanistan	AFG	44	68.65	0.19%	0.000	5	43745.57	3.36%	0.001

Developing countries	ISO3 Code	Aggregate mitigation finance				Overall ODA			
		Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)	Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)
Senegal	SEN	45	68.62	0.19%	0.000	27	13962.85	1.07%	0.000
Kazakhstan	KAZ	46	67.47	0.18%	0.000	86	3274.24	0.25%	0.000
Georgia	GEO	47	66.15	0.18%	0.000	48	7659.64	0.59%	0.000
Ghana	GHA	48	60.35	0.16%	0.000	16	21137.27	1.62%	0.000
Namibia	NAM	49	57.39	0.16%	0.000	87	3189.9	0.25%	0.000
Yemen	YEM	50	56.87	0.15%	0.000	47	8420.4	0.65%	0.000
Albania	ALB	51	54.03	0.15%	0.000	55	6378.2	0.49%	0.000
Cambodia	KHM	52	52.79	0.14%	0.000	45	9430.08	0.72%	0.000
Ecuador	ECU	53	45.75	0.12%	0.000	80	3997.19	0.31%	0.000
Tajikistan	TJK	54	42.85	0.12%	0.000	77	4122.7	0.32%	0.000
Malawi	MWI	55	41.26	0.11%	0.000	41	10466.18	0.80%	0.000
Costa Rica	CRI	56	37.42	0.10%	0.000	108	1598.87	0.12%	0.000
Kyrgyz Republic	KGZ	57	36.35	0.10%	0.000	70	4540.87	0.35%	0.000
El Salvador	SLV	58	35.73	0.10%	0.000	71	4502.77	0.35%	0.000
Mali	MLI	59	35.25	0.10%	0.000	32	12477.33	0.96%	0.000
Dominican Republic	DOM	60	30.98	0.08%	0.000	84	3393.43	0.26%	0.000
Angola	AGO	61	29.84	0.08%	0.000	49	7350.22	0.56%	0.000
Chad	TCD	62	27.53	0.07%	0.000	60	5573.14	0.43%	0.000
Solomon Islands	SLB	63	24.14	0.07%	0.000	92	2725.71	0.21%	0.000
Cape Verde	CPV	64	23.59	0.06%	0.000	91	2743.03	0.21%	0.000
Madagascar	MDG	65	22.04	0.06%	0.000	38	11133.82	0.86%	0.000
Maldives	MDV	66	21.32	0.06%	0.000	126	771.59	0.06%	0.000
Cuba	CUB	67	21.07	0.06%	0.000	110	1435.5	0.11%	0.000

Developing countries	ISO3 Code	Aggregate mitigation finance				Overall ODA			
		Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)	Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)
Malaysia	MYS	68	20.82	0.06%	0.000	69	4660.61	0.36%	0.000
Samoa	WSM	69	20.33	0.06%	0.000	119	1062.86	0.08%	0.000
Cote d'Ivoire	CIV	70	18.78	0.05%	0.000	33	12453.93	0.96%	0.000
Colombia	COL	71	18.08	0.05%	0.000	29	13518.2	1.04%	0.000
Rwanda	RWA	72	18.02	0.05%	0.000	44	9580.15	0.74%	0.000
West Bank & Gaza Strip	WBG	73	16.40	0.04%	0.000	20	18839.23	1.45%	0.000
Benin	BEN	74	16.33	0.04%	0.000	50	7325.43	0.56%	0.000
Bhutan	BTN	75	14.70	0.04%	0.000	111	1405.28	0.11%	0.000
Montenegro	MNE	76	14.59	0.04%	0.000	129	631.54	0.05%	0.000
Micronesia, Fed. States	FSM	77	13.69	0.04%	0.000	107	1626.38	0.12%	0.000
Djibouti	DJI	78	13.50	0.04%	0.000	105	1677.84	0.13%	0.000
Myanmar	MMR	79	13.49	0.04%	0.000	90	2778.55	0.21%	0.000
Argentina	ARG	80	12.66	0.03%	0.000	98	2209.99	0.17%	0.000
Timor-Leste	TMP	81	12.65	0.03%	0.000	81	3922.02	0.30%	0.000
Honduras	HND	82	12.44	0.03%	0.000	39	10869.72	0.84%	0.000
Congo, Rep.	COG	83	11.88	0.03%	0.000	58	5851.97	0.45%	0.000
Jamaica	JAM	84	11.70	0.03%	0.000	99	2198.87	0.17%	0.000
Guatemala	GTM	85	11.31	0.03%	0.000	57	5864.62	0.45%	0.000
Nigeria	NGA	86	11.31	0.03%	0.000	8	34227	2.63%	0.001
Panama	PAN	87	10.97	0.03%	0.000	117	1091.96	0.08%	0.000
Marshall Islands	MHL	88	10.80	0.03%	0.000	125	874.43	0.07%	0.000
Sudan	SDN	89	10.60	0.03%	0.000	21	18377.62	1.41%	0.000
Palau	PLW	90	9.95	0.03%	0.000	142	433.75	0.03%	0.000

Developing countries	ISO3 Code	Aggregate mitigation finance				Overall ODA			
		Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)	Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)
Liberia	LBR	91	9.93	0.03%	0.000	56	6343.25	0.49%	0.000
Lao PDR	LAO	92	9.66	0.03%	0.000	64	5188.55	0.40%	0.000
Macedonia, FYR	MKD	93	9.37	0.03%	0.000	76	4123.23	0.32%	0.000
Mauritania	MRT	94	8.88	0.02%	0.000	68	4842.74	0.37%	0.000
Haiti	HTI	95	8.68	0.02%	0.000	36	11363.86	0.87%	0.000
Uruguay	URY	96	8.56	0.02%	0.000	132	582.49	0.04%	0.000
Lebanon	LBN	97	8.38	0.02%	0.000	53	6926.53	0.53%	0.000
Gabon	GAB	98	8.24	0.02%	0.000	101	1973.33	0.15%	0.000
Niger	NER	99	7.67	0.02%	0.000	51	7310.26	0.56%	0.000
Burundi	BDI	100	6.95	0.02%	0.000	59	5581.15	0.43%	0.000
Botswana	BWA	101	6.86	0.02%	0.000	102	1966.31	0.15%	0.000
Papua New Guinea	PNG	102	6.33	0.02%	0.000	52	7215.78	0.55%	0.000
Algeria	DZA	103	6.32	0.02%	0.000	62	5298.3	0.41%	0.000
Nauru	NRU	104	6.03	0.02%	0.000	149	273.73	0.02%	0.000
Belize	BLZ	105	5.77	0.02%	0.000	133	568.65	0.04%	0.000
Zimbabwe	ZWE	106	5.27	0.01%	0.000	63	5235.78	0.40%	0.000
Iran	IRN	107	4.90	0.01%	0.000	103	1804.99	0.14%	0.000
Syria	SYR	108	4.43	0.01%	0.000	74	4218.82	0.32%	0.000
Tonga	TON	109	3.86	0.01%	0.000	134	555.13	0.04%	0.000
Swaziland	SWZ	110	3.78	0.01%	0.000	122	953.69	0.07%	0.000
Vanuatu	VUT	111	3.55	0.01%	0.000	118	1069.78	0.08%	0.000
Fiji	FJI	112	3.46	0.01%	0.000	124	881.39	0.07%	0.000
Gambia	GMB	113	3.20	0.01%	0.000	112	1342.53	0.10%	0.000

Developing countries	ISO3 Code	Aggregate mitigation finance				Overall ODA			
		Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)	Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)
Niue	NIU	114	2.60	0.01%	0.000	156	179.63	0.01%	0.000
Cook Islands	COK	115	2.38	0.01%	0.000	153	208.83	0.02%	0.000
Oman	OMN	116	2.23	0.01%	0.000	123	927.53	0.07%	0.000
Turkmenistan	TKM	117	1.93	0.01%	0.000	139	498.04	0.04%	0.000
Moldova	MDA	118	1.93	0.01%	0.000	83	3576.82	0.27%	0.000
Slovenia	SVN	119	1.85	0.01%	0.000	128	632.69	0.05%	0.000
Tuvalu	TUV	120	1.55	0.00%	0.000	154	206.14	0.02%	0.000
Sierra Leone	SLE	121	1.26	0.00%	0.000	61	5431.19	0.42%	0.000
Guinea-Bissau	GNB	122	1.15	0.00%	0.000	109	1553.32	0.12%	0.000
Comoros	COM	123	1.05	0.00%	0.000	131	611.08	0.05%	0.000
Venezuela	VEN	124	0.95	0.00%	0.000	121	1032.11	0.08%	0.000
Sao Tome & Principe	STP	125	0.60	0.00%	0.000	127	634.67	0.05%	0.000
St.Vincent & Grenadines	VCT	126	0.54	0.00%	0.000	147	370.39	0.03%	0.000
Trinidad and Tobago	TTO	127	0.47	0.00%	0.000	148	306.35	0.02%	0.000
St. Kitts-Nevis	KNA	128	0.45	0.00%	0.000	150	269.88	0.02%	0.000
Central African Rep.	CAF	129	0.39	0.00%	0.000	93	2555	0.20%	0.000
Equatorial Guinea	GNQ	130	0.37	0.00%	0.000	137	541.75	0.04%	0.000
Kiribati	KIR	131	0.37	0.00%	0.000	146	383.51	0.03%	0.000
St. Helena	SHN	132	0.35	0.00%	0.000	140	477.05	0.04%	0.000
Belarus	BLR	133	0.25	0.00%	0.000	136	542.08	0.04%	0.000
Seychelles	SYC	134	0.24	0.00%	0.000	143	432.56	0.03%	0.000
Guinea	GIN	135	0.21	0.00%	0.000	72	4493.02	0.35%	0.000
States Ex-Yugoslavia	SFR	136	0.21	0.00%	0.000	95	2487.59	0.19%	0.000

Developing countries	ISO3 Code	Aggregate mitigation finance				Overall ODA			
		Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)	Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)
Suriname	SUR	137	0.18	0.00%	0.000	113	1332.33	0.10%	0.000
St. Lucia	LCA	138	0.16	0.00%	0.000	135	545.39	0.04%	0.000
Barbados	BRB	139	0.14	0.00%	0.000	155	183.68	0.01%	0.000
Togo	TGO	140	0.12	0.00%	0.000	89	2786.41	0.21%	0.000
Saudi Arabia	SAU	141	0.11	0.00%	0.000	152	231.71	0.02%	0.000
Libya	LBY	142	0.09	0.00%	0.000	151	237.04	0.02%	0.000
Dominica	DMA	143	0.04	0.00%	0.000	141	443.22	0.03%	0.000
Eritrea	ERI	144	0.04	0.00%	0.000	85	3380.9	0.26%	0.000
Antigua and Barbuda	ATG	145	0.04	0.00%	0.000	158	125.37	0.01%	0.000
Grenada	GRD	146	0.04	0.00%	0.000	144	425.36	0.03%	0.000
Lesotho	LSO	147	0.03	0.00%	0.000	97	2246.89	0.17%	0.000
Montserrat	MSR	148	0.03	0.00%	0.000	130	619.24	0.05%	0.000
Wallis & Futuna	WLF	149	0.00	0.00%	-	116	1261.57	0.10%	0.000
New Caledonia	NCL	150	0	0.00%	-	120	1045.98	0.08%	0.000
French Polynesia	PYF	151	0	0.00%	-	114	1280.09	0.10%	0.000
Korea	KOR	152	0	0.00%	-	145	395.32	0.03%	0.000
Virgin Islands (UK)	VGB	153	0	0.00%	-	163	6.78	0.00%	0.000
Anguilla	AIA	154	0	0.00%	-	161	56.01	0.00%	0.000
Korea, Dem. Rep.	PRK	155	0	0.00%	-	100	2163.17	0.17%	0.000
Gibraltar	GIB	156	0	0.00%	-	167	0.3	0.00%	0.000
Kosovo	KSV	157	0	0.00%	-	115	1262.9	0.10%	0.000
Hong Kong	HKG	158	0	0.00%	-	178	0	0.00%	-
Tokelau	TKL	159	0	0.00%	-	157	150.56	0.01%	0.000

Developing countries	ISO3 Code	Aggregate mitigation finance				Overall ODA			
		Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)	Rank	Commitment received in million US$2010	% share from total	Herfindahl index (share^2)
Singapore	SGP	160	0	0.00%	-	180	0	0.00%	-
Israel	ISR	161	0	0.00%	-	173	0	0.00%	-
Kuwait	KWT	162	0	0.00%	-	176	0	0.00%	-
Somalia	SOM	163	0	0.00%	-	75	4212.61	0.32%	0.000
Brunei Darussalam	BRN	164	0	0.00%	-	169	0	0.00%	-
Turks and Caicos Islands	TCA	165	0	0.00%	-	160	70.9	0.01%	0.000
Falkland Islands (Malvinas)	FLK	166	0	0.00%	-	172	0	0.00%	-
Northern Marianas	MNP	167	0	0.00%	-	166	0.45	0.00%	0.000
Netherlands Antilles	ANT	168	0	0.00%	-	162	33.23	0.00%	0.000
Malta	MLT	169	0	0.00%	-	159	106.24	0.01%	0.000
Bahrain	BHR	170	0	0.00%	-	138	534.21	0.04%	0.000
Cayman Islands	CYM	171	0	0.00%	-	171	0	0.00%	-
Bahamas, The	BHS	172	0	0.00%	-	177	0	0.00%	-
Chinese Taipei	TWN	173	0	0.00%	-	174	0	0.00%	-
Mayotte	MYT	174	0	0.00%	-	79	4040.18	0.31%	0.000
Aruba	ABW	175	0	0.00%	-	165	0.47	0.00%	0.000
Cyprus	CYP	176	0	0.00%	-	168	0	0.00%	-
United Arab Emirates	ARE	177	0	0.00%	-	170	0	0.00%	-
Macao	MAC	178	0	0.00%	-	164	1.95	0.00%	0.000
Bermuda	BMU	179	0	0.00%	-	179	0	0.00%	-
Qatar	QAT	180	0	0.00%	-	175	0	0.00%	-
Total commitment			36714.5	100.00%	0.105**		1301342.2	100.00%	0.020**

Note: The shaded countries are the five largest recipients of either mitigation finance or overall ODA, poverty aid is not presented due to its similar outlook with overall ODA.

LIST OF DONORS

No.	Donor	Country Code
1	Australia	AUS
2	Austria	AUT
3	Belgium	BEL
4	Canada	CAN
5	Denmark	DNK
6	Finland	FIN
7	France	FRA
8	Germany	DEU
9	Greece	GRC
10	Ireland	IRL
11	Italy	ITA
12	Japan	JPN
13	Korea, Rep.	KOR
14	Netherlands	NLD
15	New Zealand	NZL
16	Norway	NOR
17	Portugal	PRT
18	Spain	ESP
19	Sweden	SWE
20	Switzerland	CHE
21	United Kingdom	GBR
22	United States	USA
23	EU institutions	EUI

APPENDIX 3.2: LIST OF VARIABLES AND DATA SOURCES

Variable label	Definition	Data Source
binarycfcommit	1 if the amount of mitigation finance commitment> 0, 0 otherwise	OECD (2012a)
binarycfdisburse	1 if the amount of mitigation finance disbursement> 0, 0 otherwise	
binarypovaidcommit	1 if the amount of total ODA commitment subtracted by mitigation finance commitment principal and significant> 0, 0 otherwise	OECD (2012a, 2012b)
binarypovaiddisburse	1 if the amount of total ODA disbursement subtracted by mitigation finance disbursement principal and significant> 0, 0 otherwise	
binarytotalodacommit	1 if the amount of total ODA commitment> 0, 0 otherwise	OECD (2012b)
binarytotalodadisburse	1 if the amount of total ODA disbursement> 0, 0 otherwise	
lncfcommit	Log of the amount of mitigation finance commitment in million US$ constant 2010	OECD (2012a)
lncfdisburse	Log of the amount of mitigation finance disbursement in million US$ constant 2010	
lnpovaidcommit	Log of the amount of total ODA commitment subtracted by mitigation finance commitment principal and significant in million US$ constant 2010	OECD (2012a, 2012b)
lnpovaiddisburse	Log of the amount of total ODA disbursement subtracted by mitigation finance disbursement principal and significant in million US$ constant 2010	
lntotalodacommit	Log of the amount of total ODA commitment in million US$ constant 2010	OECD (2012b)
lntotalodadisburse	Log of the amount of total ODA disbursement in million US$ constant 2010	
lnco2	Log of CO_2 (Carbon dioxide) in kilo ton	WDI (2013)
lnch4	Log of CH_4 (Methane) in kilo ton CO_2 equivalent	UNFCCC (2012)
lnn2o	Log of N_2O (Nitrous oxide) in kilo ton CO_2 equivalent	
lnhfcs	Log of HFCs (Hydrofluorocarbons) in kilo ton CO_2 equivalent	
lnpfcs	Log of PFCs (Perfluorocarbons) in kilo ton CO_2 equivalent	
lnsf6	Log of CH_6 (Sulphur hexafluoride) in kilo ton CO_2 equivalent	
lnghg	Log of sum kilo ton CO_2 equivalent of CO_2, CH_4, N_2O	
rci	CO_2 emission intensity at year-t/ CO_2 emission intensity at year t-1	Author's calculation (GDP and CO_2 data are from WDI (2013))

Variable label	Definition	Data Source
lnforest	Log of forest area in 1000Ha	FAO (2013)
marine	Marine protected areas (% of territorial waters)	WDI (2013)
deforest	Gain or loss in % of the remaining forest area each year within the given period	FAO (2013)
govern	The average of Kaufmann Institutional measures: *regulatory quality, rule of law voice and accountability*, *control of corruption*, *political stability* and *government effectiveness*. Each has a -2.5 to 2.5 index. The higher values correspond to a higher quality of governance.	Kaufmann *et al.* (2010)
lngdppc	Log of GDP per capita in US$ constant 2000	WDI (2013)
lninfant	Log of mortality rate, infant (per 1,000 live births)	(*ibid*)
lnpop	Log of population size	(*ibid*)
fdiinflow	Percentage of Foreign Direct Investment (FDI) inflow in GDP	(*ibid*)
democracy	Polity2 score, democracy subtracted by autocracy score. Both are measured using an index from 0 to 10. The higher values correspond to more democratic states	Marshall *et al.* (2011)
xcolony	Dummy 1 for ex-colony of DAC donors, 0 otherwise	Hensel (2009)
reddplus	Dummy 1 for country indicated as a potential site for REDD+ projects	UNDP (2011)
smallisland	Dummy 1 for small island states, 0 otherwise	OECD (2012)
opecmember	Dummy 1 for OPEC member, 0 otherwise	OPEC (2013)
regional dummies	Dummy 1 for country located in the respective region, 0 otherwise	WDI (2013)

APPENDIX 3.3: CORRELATION MATRIX

	binarycf commit	binarycf disburse	binarypovaid commit	binarypovaid disburse	binaryoda commit	binaryoda disburse	lncfcommit
binarycfcommit	1.0000						
binarycfdisburse	0.7447*	1.0000					
	0.0000						
binarypovaidcommit	0.6322*	0.6149*	1.0000				
	0.0000	0.0000					
binarypovaiddisburse	0.6184*	0.5988*	0.9821*	1.0000			
	0.0000	0.0000	0.0000				
binaryodacommit	0.3612*	0.3513*	0.5713*	0.5610*	1.0000		
	0.0000	0.0000	0.0000	0.0000			
binaryodadisburse	0.3612*	0.3513*	0.5713*	0.5610*	0.9965*	1.0000	
	0.0000	0.0000	0.0000	0.0000	0.0000		
lncfcommit	.	0.0936*	.	-0.0607	.	.	1.0000
	.	0.0026	.	0.0511	.	.	
lncfdisburse	0.1832*	.	.	-0.0147	.	.	0.6736*
	0.0000	.	.	0.6417	.	.	0.0000
lnpovaidcommit	0.2416*	0.1726*	.	0.0491	.	.	0.4122*
	0.0000	0.0000	.	0.0528	.	.	0.0000
lnpovaiddisburse	0.2221*	0.1660*	.	.	.	.	0.3690*
	0.0000	0.0000	.	.	.	.	0.0000
lntotalodacommit	0.4126*	0.3622*	0.4529*	0.4470*	.	0.0260	0.4505*
	0.0000	0.0000	0.0000	0.0000	.	0.2432	0.0000
lntotalodadisburse	0.3804*	0.3398*	0.4242*	0.4289*	0.0327	.	0.3914*
	0.0000	0.0000	0.0000	0.0000	0.1460	.	0.0000
lnforest	0.3681*	0.3402*	0.4286*	0.4184*	0.3031*	0.2991*	0.2716*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
deforest	-0.0788*	-0.0480*	-0.1008*	-0.1009*	-0.1826*	-0.1826*	0.1180*
	0.0002	0.0250	0.0000	0.0000	0.0000	0.0000	0.0002
rci	0.1280*	0.1209*	0.0876*	0.0254	0.0723*	0.0723*	0.0681
	0.0003	0.0006	0.0136	0.4750	0.0418	0.0418	0.1464
marine	0.1531*	0.1357*	0.1591*	0.1581*	0.1162*	0.1161*	-0.0211
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5623
govern	-0.1702*	-0.1671*	-0.3514*	-0.3559*	-0.5035*	-0.5035*	-0.0107
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7472
lngdppc	-0.2242*	-0.2013*	-0.4244*	-0.4326*	-0.5464*	-0.5435*	-0.0428
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1805
lninfant	0.0720*	0.0653*	0.2691*	0.2821*	0.4842*	0.4850*	-0.0147
	0.0012	0.0033	0.0000	0.0000	0.0000	0.0000	0.6403
lnpop	0.3952*	0.3353*	0.3916*	0.3778*	0.2542*	0.2530*	0.3976*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
fdiinflow	-0.0337	-0.0094	-0.0825*	-0.0805*	-0.0388	-0.0389	-0.0718*
	0.1344	0.6748	0.0002	0.0003	0.0847	0.0841	0.0235
democracy	0.1990*	0.1775*	0.1891*	0.1800*	0.0798*	0.0798*	0.0110
	0.0000	0.0000	0.0000	0.0000	0.0012	0.0012	0.7402
xcolony	0.0806*	0.1034*	0.1569*	0.1618*	0.1842*	0.1842*	0.0028
	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.9271
reddplus	0.2935*	0.2850*	0.3208*	0.3022*	0.2378*	0.2378*	0.0919*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0031
smallisland	-0.1160*	-0.0643*	-0.0608*	-0.0598*	0.1444*	0.1444*	-0.2166*
	0.0000	0.0019	0.0032	0.0038	0.0000	0.0000	0.0000
opecmember	-0.0412*	-0.0512*	-0.0822*	-0.0808*	-0.1226*	-0.1226*	-0.0729*
	0.0465	0.0132	0.0001	0.0001	0.0000	0.0000	0.0191
lnco2	0.2384*	0.1893*	0.1015*	0.0869*	-0.1136*	-0.1146*	0.3301*
	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000
lnch4	0.2745*	0.3546*	0.2815*	0.2755*	0.0717	0.0717	0.3491*
	0.0000	0.0000	0.0000	0.0000	0.2396	0.2396	0.0004

	binarycf commit	binarycf disburse	binarypovaid commit	binarypovaid disburse	binaryoda commit	binaryoda disburse	lncfcommit
lnn2o	0.2327*	0.3280*	0.2428*	0.2455*	0.0211	0.0211	0.3093*
	0.0001	0.0000	0.0001	0.0001	0.7315	0.7315	0.0021
lnhfcs	0.2522*	0.3485*	0.0705	0.0589	-0.0046	-0.0046	0.5276*
	0.0011	0.0000	0.3696	0.4537	0.9538	0.9538	0.0000
lnpfcs	0.1316	0.2104	0.0548	0.0937	0.0889	0.0889	0.3392
	0.2243	0.0504	0.6143	0.3881	0.4127	0.4127	0.0667
lnsf6	0.4005*	0.5469*	0.3546*	0.3560*	0.2983*	0.2983*	0.3466*
	0.0000	0.0000	0.0000	0.0000	0.0007	0.0007	0.0245
lnghg	0.2044	0.6765*	-0.0960	-0.0960	.	.	0.5433
	0.5467	0.0223	0.7789	0.7789	.	.	0.1640

	lncf disburse	lnpovaid commit	lnpovaid disburse	lntotaloda commit	lntotaloda disburse	lnforest	deforest
lncfdisburse	1.0000						
lnpovaidcommit	0.4491*	1.0000					
	0.0000						
lnpovaiddisburse	0.4006*	0.9309*	1.0000				
	0.0000	0.0000					
lntotalodacommit	0.4728*	0.9974*	0.9277*	1.0000			
	0.0000	0.0000	0.0000				
lntotalodadisburse	0.4292*	0.9317*	0.9980*	0.9342*	1.0000		
	0.0000	0.0000	0.0000	0.0000			
lnforest	0.3086*	0.5263*	0.4808*	0.6105*	0.5612*	1.0000	
	0.0000	0.0000	0.0000	0.0000	0.0000		
deforest	0.1296*	-0.1104*	-0.1319*	-0.0634*	-0.0789*	-0.1468*	1.0000
	0.0000	0.0000	0.0000	0.0053	0.0006	0.0000	
rci	-0.0384	-0.0665	-0.0448	-0.0525	-0.0340	0.0291	0.0515
	0.4310	0.0912	0.2592	0.1511	0.3578	0.4228	0.1526
marine	0.0016	-0.0132	-0.0189	0.0521	0.0391	0.1715*	-0.1379*
	0.9660	0.6615	0.5340	0.0508	0.1472	0.0000	0.0000
govern	-0.0085	-0.3744*	-0.4086*	-0.4075*	-0.4403*	-0.4553*	0.2442*
	0.7975	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
lngdppc	-0.0478	-0.4993*	-0.5490*	-0.5191*	-0.5506*	-0.4008*	0.3378*
	0.1430	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
lninfant	-0.0590	0.3354*	0.3678*	0.3286*	0.3643*	0.3497*	-0.3502*
	0.0654	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
lnpop	0.4364*	0.7283*	0.6814*	0.7423*	0.7119*	0.7008*	-0.0935*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
fdiinflow	-0.0898*	-0.1557*	-0.1347*	-0.1587*	-0.1440*	-0.1796*	0.0304
	0.0055	0.0000	0.0000	0.0000	0.0000	0.0000	0.1843
democracy	0.0507	0.0404	-0.0261	0.1148*	0.0426	0.1450*	-0.1393*
	0.1386	0.1450	0.3510	0.0000	0.0999	0.0000	0.0000
xcolony	-0.0164	0.0569*	0.0363	0.0859*	0.0657*	0.0190	-0.0657*
	0.6032	0.0248	0.1548	0.0001	0.0035	0.4185	0.0021
reddplus	0.1142*	0.2664*	0.2319*	0.3299*	0.2944*	0.4893*	-0.1833*
	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
smallisland	-0.2554*	-0.5430*	-0.5491*	-0.5115*	-0.5249*	-0.4110*	-0.0119
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5780
opecmember	-0.0724*	-0.0083	0.0031	0.0134	0.0271	0.0586*	-0.0054
	0.0220	0.7436	0.9041	0.5481	0.2275	0.0123	0.8022
lnco2	0.4129*	0.3736*	0.3162*	0.4133*	0.3872*	0.3946*	0.1407*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
lnch4	0.4810*	0.4052*	0.3426*	0.4106*	0.3547*	0.7463*	0.0400
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5234
lnn2o	0.3376*	0.3283*	0.2867*	0.3542*	0.3063*	0.7229*	0.0253
	0.0037	0.0000	0.0003	0.0000	0.0000	0.0000	0.6889
lnhfcs	0.5251*	0.5190*	0.4365*	0.2082*	0.1552	0.4354*	-0.2252*
	0.0001	0.0000	0.0000	0.0219	0.0920	0.0000	0.0054

	lncf disburse	lnpovaid commit	lnpovaid disburse	lntotaloda commit	lntotaloda disburse	lnforest	deforest
lnpfcs	0.0984	0.5915*	0.4998*	0.2800*	0.2318	0.5720*	0.2962*
	0.5799	0.0000	0.0006	0.0317	0.0827	0.0000	0.0104
lnsf6	0.3891*	0.6054*	0.2685*	0.4779*	0.3188*	0.3504*	-0.0503
	0.0131	0.0000	0.0364	0.0000	0.0033	0.0002	0.5949
lnghg	0.2255	0.2582	0.2223	0.2436	0.2082	0.7343*	-0.2508
	0.6269	0.4714	0.5371	0.4704	0.5389	0.0101	0.4570

	rci	marine	govern	lngdppc	lninfant	lnpop	fdiinflow
rci	1.0000						
marine	0.0003	1.0000					
	0.9933						
govern	0.1163*	-0.1065*	1.0000				
	0.0022	0.0001					
lngdppc	0.0619	-0.0931*	0.7320*	1.0000			
	0.0861	0.0003	0.0000				
lninfant	-0.1119*	0.0966*	-0.6573*	-0.8196*	1.0000		
	0.0017	0.0001	0.0000	0.0000			
lnpop	-0.0992*	0.0819*	-0.4794*	-0.3635*	0.2311*	1.0000	
	0.0052	0.0009	0.0000	0.0000	0.0000		
fdiinflow	0.1254*	-0.0463	0.1646*	0.0954*	-0.0597*	-0.2237*	1.0000
	0.0005	0.0737	0.0000	0.0000	0.0088	0.0000	
democracy	-0.0030	0.0855*	0.3521*	0.0234	-0.1497*	-0.0236	0.0102
	0.9358	0.0026	0.0000	0.3502	0.0000	0.3383	0.6842
xcolony	-0.0666	-0.0849*	-0.0436	-0.0861*	0.1988*	-0.0320	-0.0175
	0.0611	0.0006	0.0669	0.0001	0.0000	0.1376	0.4358
reddplus	-0.0649	0.1624*	-0.1982*	-0.2480*	0.2010*	0.2991*	-0.0331
	0.0680	0.0000	0.0000	0.0000	0.0000	0.0000	0.1407
smallisland	0.0559	0.0052	0.2850*	0.1885*	-0.1848*	-0.5594*	0.1153*
	0.1161	0.8320	0.0000	0.0000	0.0000	0.0000	0.0000
opecmember	-0.0285	0.1210*	-0.1286*	0.1648*	-0.0760*	0.1585*	-0.0806*
	0.4226	0.0000	0.0000	0.0000	0.0006	0.0000	0.0003
lnco2	0.0160	0.0352	-0.0413	0.2290*	-0.2954*	0.7460*	-0.1508*
	0.6538	0.1767	0.1051	0.0000	0.0000	0.0000	0.0000
lnch4	-0.0791	0.2188*	-0.3980*	-0.0877	0.1776*	0.9134*	-0.3118*
	0.3441	0.0034	0.0000	0.1609	0.0042	0.0000	0.0000
lnn2o	-0.3904*	0.3134*	-0.3928*	-0.0947	0.1171	0.8746*	-0.3102*
	0.0000	0.0000	0.0000	0.1329	0.0625	0.0000	0.0000
lnhfcs	-0.2621*	0.2696*	0.0817	0.2795*	0.0987	0.4649*	-0.0059
	0.0136	0.0070	0.3535	0.0005	0.2281	0.0000	0.9430
lnpfcs	-0.0015	0.4061*	-0.3863*	-0.0769	0.3672*	0.6063*	0.1974
	0.9931	0.0005	0.0021	0.5150	0.0013	0.0000	0.0941
lnsf6	0.1905	0.2675*	0.1352	0.3322*	0.1362	0.4636*	-0.2526*
	0.1316	0.0113	0.1868	0.0003	0.1483	0.0000	0.0067
lnghg	-0.9084*	-0.3132	0.2578	0.3419	-0.2531	0.5660	-0.0762
	0.0328	0.4118	0.4440	0.3034	0.4527	0.0695	0.8239

	democracy	xcolony	reddplus	smallisland	opecmember
democracy	1.0000				
xcolony	-0.0888*	1.0000			
	0.0003				
reddplus	0.1837*	0.1271*	1.0000		
	0.0000	0.0000			
smallisland	0.1604*	0.2384*	-0.1664*	1.0000	
	0.0000	0.0000	0.0000		

	democracy	xcolony	reddplus	smallisland	opecmember
opecmember	-0.2615*	0.0422*	-0.0545*	-0.1452*	1.0000
	0.0000	0.0410	0.0084	0.0000	
lnco2	-0.0593*	-0.2067*	0.0412	-0.4755*	0.3248*
	0.0215	0.0000	0.0716	0.0000	0.0000
lnch4	-0.0590	-0.2030*	0.0529	-0.4386*	0.1196*
	0.3687	0.0008	0.3858	0.0000	0.0493
lnn2o	-0.0879	-0.2339*	0.0479	-0.4613*	0.1583*
	0.1830	0.0001	0.4354	0.0000	0.0096
lnhfcs	0.3021*	0.0850	0.2951*	-0.1737*	-0.0539
	0.0003	0.2789	0.0001	0.0261	0.4928
lnpfcs	-0.3149*	0.0087	0.0989	-0.5299*	0.1266
	0.0067	0.9361	0.3620	0.0000	0.2425
lnsf6	0.4554*	0.1234	0.1664	0.0738	0.0782
	0.0000	0.1670	0.0614	0.4097	0.3819
lnghg	0.2960	0.4975	0.2143	-0.3135	.
	0.4063	0.1194	0.5268	0.3479	.

	lnco2	lnch4	lnn2o	lnhfcs	lnpfcs	lnsf6	lnghg
lnco2	1.0000						
lnch4	0.8615*	1.0000					
	0.0000						
lnn2o	0.7594*	0.8770*	1.0000				
	0.0000	0.0000					
lnhfcs	0.4861*	0.4256*	0.4055*	1.0000			
	0.0000	0.0000	0.0000				
lnpfcs	0.6966*	0.5732*	0.6147*	0.3736*	1.0000		
	0.0000	0.0000	0.0000	0.0008			
lnsf6	0.3660*	0.3392*	0.2781*	0.5781*	0.4462*	1.0000	
	0.0001	0.0001	0.0016	0.0000	0.0001		
lnghg	0.3571	0.5217	0.6538*	0.7650	1.0000*	-0.9526	1.0000
	0.2810	0.0997	0.0403	0.1318	0.0000	0.1969	

Note: *denotes significance at the 5% level. Unreported variables are available upon request
Continued in the next page.

APPENDIX 3.4: HECKMAN SELECTION MODEL

Table 3.14: The determinants of mitigation finance using Heckman Selection Model

	Commitment		Disbursement	
Mitigation finance	Selection (71)	Allocation (72)	Selection (73)	Allocation (74)
lnco2	0.178*	0.112	0.091	0.250
	(1.860)	(0.631)	(0.868)	(1.093)
lnforest	0.072*	0.134	0.104**	0.134
	(1.759)	(1.365)	(2.383)	(1.448)
deforest	0.024	0.274**	0.082	0.249**
	(0.564)	(2.127)	(1.500)	(2.086)
govern	0.507***	1.391***	0.601***	1.328***
	(2.762)	(4.246)	(3.157)	(3.557)
lngdppc	-0.420***	-0.697***	-0.337**	-0.894***
	(-2.914)	(-2.719)	(-2.318)	(-2.792)
lninfant	-0.002	-0.175	0.089	-0.325
	(-0.008)	(-0.611)	(0.472)	(-0.929)
lnpop	0.109	0.760***	0.177	0.562*
	(0.861)	(3.457)	(1.266)	(1.851)
fdiinflow	0.007	0.053***	0.005	0.014
	(0.536)	(2.779)	(0.384)	(0.510)
democracy	0.021	0.016	0.015	0.028
	(1.625)	(0.573)	(1.082)	(0.944)
xcolony	-0.035	-0.105	-0.005	-0.044
	(-0.197)	(-0.314)	(-0.029)	(-0.111)
reddplus	0.532***		0.593***	
	(2.982)		(2.704)	
χ^2	262.9		180.1	
P-values		0.000		0.000
N		1146		1146

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively

APPENDIX 3.5: ADDITIONAL ROBUSTNESS CHECKS

Table 3.15: Alternating between lngdppc and lninfant

	Without *lninfant*		Without *lngdppc*	
	Selection	Allocation	Selection	Allocation
	(75)	(76)	(77)	(78)
lnco2	0.127	0.100	-0.086	-0.149
	(1.363)	(0.783)	(-1.226)	(-1.535)
lnforest	0.209***	0.066	0.194***	0.058
	(5.462)	(1.071)	(5.050)	(0.945)
deforest	-0.014	0.304***	-0.006	0.312***
	(-0.250)	(3.667)	(-0.115)	(3.598)
govern	0.784***	1.198***	0.544***	0.953***
	(3.883)	(4.473)	(2.938)	(3.665)
lngdppc	-0.492***	-0.489***		
	(-3.595)	(-2.964)		
lninfant			0.241	0.124
			(1.462)	(0.633)
lnpop	0.320***	0.661***	0.564***	0.945***
	(2.648)	(4.151)	(5.822)	(7.283)
fdiinflow	0.018	0.052***	0.020	0.055***
	(0.929)	(3.111)	(1.050)	(3.196)
democracy	0.041***	0.006	0.048***	0.006
	(2.953)	(0.275)	(3.491)	(0.266)
xcolony	-0.114	-0.093	-0.268	-0.205
	(-0.703)	(-0.421)	(-1.641)	(-0.918)
χ^2	276.8		272.7	
R^2		0.268		0.264
Adjusted R^2		0.248		0.244
P-values	0.000	0.000	0.000	0.000
N	1146	669	1155	674

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

Table 3.16: (Fixed Effect) Logit model for selected regions

	Africa (c79)	Europe (c80)
lnco2	1.024*	-1.562
	(1.793)	(-0.669)
lnforest	-8.755*	-4.379**
	(-1.715)	(-2.281)
deforest	-0.058	2.521
	(-0.186)	(1.463)
govern	2.394**	-1.089
	(2.178)	(-0.489)
lngdppc	-3.432**	2.707
	(-2.054)	(0.722)
lninfant	-2.547	-2.714
	(-0.816)	(-0.251)
lnpop	-11.468*	25.874*
	(-1.865)	(1.748)
fdiinflow	0.044*	0.077
	(1.945)	(1.320)
democracy	0.022	-0.103
	(0.297)	(-1.431)
χ^2	0.460	0.493
P-values	0.000	0.000
N	378	150

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

APPENDIX 3.6: INDIVIDUAL WORLDWIDE GOVERNANCE INDICATORS

	Selection	Allocation
Average of WGI (*govern*)	0.786***	1.177***
	(3.822)	(4.376)
Voice and accountability	0.761***	0.887***
	(4.056)	(3.638)
Political stability and absence	0.391***	0.326**
of Violence/Terrorism	(3.486)	(2.134)
Government effectiveness	0.613***	1.114***
	(3.464)	(4.278)
Regulatory quality	0.606***	0.961***
	(3.646)	(4.558)
Rule of law	0.390**	1.003***
	(2.286)	(4.739)
Control of corruption	0.205	0.474**
	(1.281)	(1.982)
P-values	0.000	0.000
N	1146	669

4. THE ALLOCATION OF CLIMATE MITIGATION FINANCE: COMPARISON ACROSS INSTRUMENTS AND DONORS

Abstract

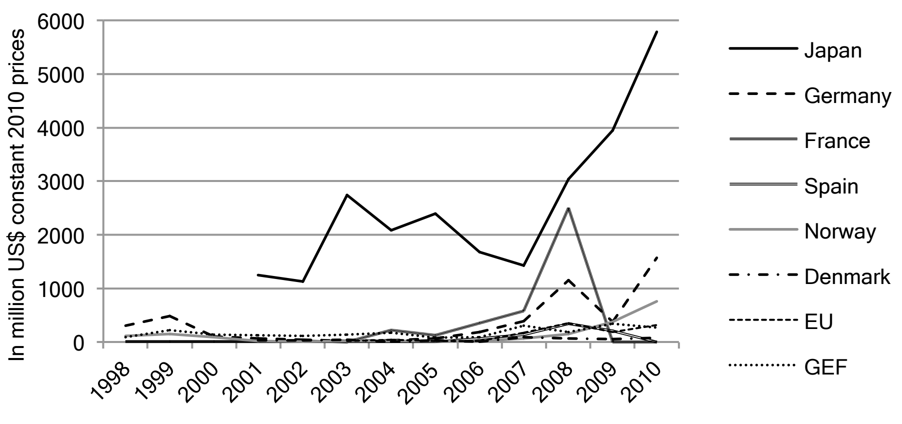
This chapter identifies the determinants used by eight major mitigation finance donors to allocate mitigation finance across developing countries. It also compares the determinants used for mitigation finance grants and loans and discusses the GEF's mitigation finance and European Union's (EU) climate finance allocation frameworks. For the first two aims, Two-part models were used to analyse mitigation finance inflows to 180 developing countries in 1998-2010 taken from the OECD Rio Marker database. The findings show that loans tend to target emission reductions via the energy sector while grants are given to the forestry sector. In the aid commitment phase the eight donors' determinants are more heterogeneous than in the disbursement phase. For some donors, CO_2 emissions are more sensitive than forest-related variables. While some donors reward recipients' performance and respond to recipients' needs, the others have stronger national interests, e.g. Japan supports its trading and regional partners and France and Spain support their ex-colonies. Interestingly, Norway indicates an interest in future benefits from carbon trading by supporting its Clean Development Mechanism (CDM) partners, *ceteris paribus*.

Keywords: Mitigation finance, Donors' performance, Individual donors

4.1. Introduction

A joint endeavour of bilateral and multilateral donors along with numerous multilateral arrangements and donor institutions (Appendix 4.1) aims to mobilise global funds including Overseas Development Assistance (ODA) as official public climate finance, which primarily consists of mitigation finance. For example, the Green Climate Fund (GCF) was established specifically to support the global need to raise and distribute climate finance with a target of 100 billion US$ per year by 2020 (Bodansky, 2010b). In response to the urgent need to fill the climate finance gap until the GCF becomes fully operational, bilateral donors have increased their commitment to providing ODA as fast-start climate finance from US$469.8 million in 1998 to US$12.4 billion in 2010, with Japan the largest contributor among the eight major mitigation finance donors (Figure 4.1). These eight major donors considered in this study have been selected based on the amount of mitigation finance they have disbursed and the share of mitigation finance in their total contribution to development aid, as shown in Figure 2.1. Another practical consideration is the availability and the clarity of their data, especially for donors that allocate their funding to specific recipient countries.

Figure 4.1: Trends in mitigation finance commitment by the eight largest mitigation finance donors



Data Source: GEF (2013); OECD (2012a)

There is currently a lack of transparency about the criteria used by bilateral and multilateral donors in allocating mitigation finance. The United Nations Framework Convention on Climate Change (UNFCCC) calls for more transparent allocation measurement, reporting, and verification (MRV) system for mitigation finance (Buchner *et al.*, 2011); as yet, little is known about how each donor allocates mitigation finance across developing countries.

To the author's knowledge there are no academic peer-reviewed studies that analyse individual donors' allocation of official mitigation finance and cover a vast coverage of 180 developing countries and countries with economies in transition. Chapter 3 identifies the determinants of mitigation finance more broadly. More specific data, i.e. types of financial instrument (grant/loan) and the strategies of individual donor countries would allow magnification of the spatiality, i.e. across individual donors and specificities of mitigation finance allocation, i.e. between different types of financial instrument.

Other studies on environmental aid allocation are also taken into account; while they have a broader scope they are still a relevant wider sub-category of aid to which mitigation finance study can refer. These broader studies show how aid for environmental projects is also used as a financial instrument to accommodate donors' economic and political interests such as a large volume of bilateral trade and ex-colonial status (Hicks *et al*., 2008b). Chapter 3 shows the determinants of global mitigation finance inflow across developing countries: emissions, increasing carbon intensity, carbon sinks, deforestation, per capita income, population, and foreign direct investment (FDI) inflow. However, it does not analyse the global allocation of mitigation finance by individual donor country.

There are studies that more specifically analyse individual donors' environmental aid allocation. Lewis (2003) examines the allocation of environmental aid by USAID, US foundations, GEF and multilateral donors. He highlights donors' preferences for the recipients' local development or for global needs and finds that multilateral donors are not more humanitarian than bilateral donors in allocating environmental aid. This finding contrasts with the finding of Nunnenkamp and Thiele's (2006) study of overall aid allocation, whereas Hicks *et al.* (2008) show that at the allocation stage, bilateral green aid that is globally beneficial is allocated to developing countries with lower per capita income. At the selection stage, multilateral grant agencies (MGAs) and multilateral development banks (MDBs) allocate environmental aid to poorer developing countries with lower income per capita, but in the allocation stage these donors tend to choose to give more environmental aid to richer recipients.

Buntaine's (2011) analysis of the Asian Development Bank (ADB)'s allocation of environmental aid finds that the Bank considers past environmental performance when approving environmentally risky projects. Other studies show that MDBs tend to provide more loans to developing countries with higher savings and higher deforestation rates compared to the other developing countries (Nielsen & Tierney, 2006). Exceptionally, the World Bank chooses to invest mitigation finance in developing countries with higher CO_2 emissions, although the US, the largest financial contributor of the World Bank, allocates its bilateral environmental aid to countries with a higher deforestation rate (Figaj, 2010).

There is heterogeneity across donors with respect to their adopted pattern of allocation of environmental aid, but little is known about mitigation finance, which has recently received considerable donor attention. This study addresses the academic literature gap with three research inquiries. The first compares the determinants of mitigation finance applied by major eight mitigation finance donors, namely Japan, Germany, France, Spain, Norway, Denmark, GEF, and EU institutions in addition to bilateral mitigation finance from EU countries. The second contrasts the determinants of mitigation finance grants and loans; and the third discusses the GEF and EU's mitigation finance allocation frameworks.

The main contribution of this study to climate policy is its close link to the Eliasch Review (2008, pp. 213–232), which calls for in-depth assessment of mitigation finance distribution. This chapter reports the results of in-depth assessment by assessing individual donors and testing variables, which have been tested in the previous chapter, and new dyadic variables that are likely to influence their allocations of public mitigation finance. One of this study's scholarly contributions is the introduction of a CDM dummy variable as a dyadic variable of a particular donor and recipient country in which the donor country's private companies have CDM investment. It allows an empirical assessment of the relationship between mitigation finance and the location that donor-country companies select in which to invest their mitigation finance to offset their carbon through the CDM.

Section 4.2 describes the global allocation of mitigation finance by eight major mitigation finance donors based on their selected instruments, selected agencies and preferred regions and recipients. Section 4.3 explains the conceptual framework used for the study. Sections 4.4 and 4.5 show the determinants used by the eight major mitigation finance donors to allocate mitigation finance and the determinants of mitigation finance grants and loans. Section 4.6 discusses the mitigation finance allocation frameworks used by the GEF and EU, and section 4.7 summarises the findings and offers concluding remarks.

4.2. Eight major donors' mitigation finance

Data on Japan, Germany, France, Spain, Norway, Denmark and the EU's mitigation finance were taken from the OECD's DAC and the CRS of the Rio Marker database, as explained in detail in the introduction.

Exceptionally, GEF mitigation finance data represent all approved projects under the focal area of climate change. According to GEF, all projects in this focal area aim to support developing countries and economies in transition with their contribution to the overall objective of the UNFCCC:

…to achieve […] stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner (Art.2).

GEF's climate finance mainly covers mitigation, with a small amount of adaptation finance. GEF does not report the two categories separately, but it defines them as follows:

Climate Change Mitigation, [whose aim is] to reduce or avoid greenhouse gas emissions in the areas of renewable energy, energy efficiency and sustainable transport, and the management of land use, land-use change and forestry (LULUCF). Climate Change Adaptation, [which aims to help] developing countries to become climate-resilient by promoting both immediate and longer-term adaptation measures in their development policies, plans, programs, projects, and actions.

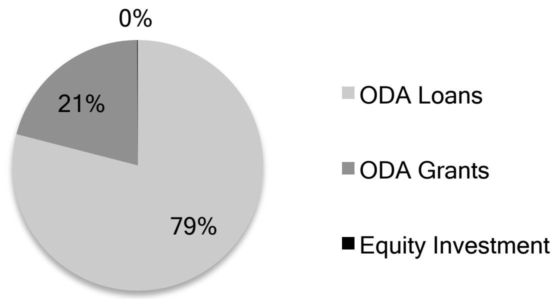
The data organisation and the method used to analyse mitigation finance data are based on the approach used in Chapter 2. Project-level aid data for 180 developing countries from 1998–2010 are categorised as annual mitigation finance commitment and disbursement in US$ constant 2010, except for GEF's project-level data, which are deflated from current US$ into US$ constant 2010 prices using Consumer Price Index (CPI) US$ (2010=1). GEF website offers a different mechanism to characterise the data compared to the OECD. The mitigation finance data provided by GEF are not separated into commitment and disbursement but show how much funding is allocated to mitigation projects that are approved by the GEF. The results of mitigation finance disbursement from the other seven donors are presented if they exhibit different patterns.

Japan's accumulated mitigation finance from 1998 to 2010 reached 20 billion US$, more than all other donors' mitigation finance combined (Figure 3.2). Germany's 10 billion US$ takes second place in terms of financing emission reduction overseas. Denmark, Norway, France and Spain, also allocate a significant share of their foreign aid as mitigation finance, but in terms of absolute value, their mitigation finance is insignificant. Other donors such as the UK, South Korea and the European Bank for Reconstruction and Development (EBRD) are important. The UK funds many individual projects whose intervention locations cover more than one country or have global coverage, such as a project to create a global emission calculator for the use of many countries (DECC, 2014). In the case of South Korea, the data are available only for 2007 and 2009 respectively.

The descriptive statistics show that different mitigation finance donors use different strategies to allocate mitigation finance. Around 79% of mitigation finance provision is made available via concessional loans. According to the OECD glossary, concessional loans are usually loaned at lower than the market rate and their concessionality varies according to given grace periods and the interest rates. Notably Japan and France

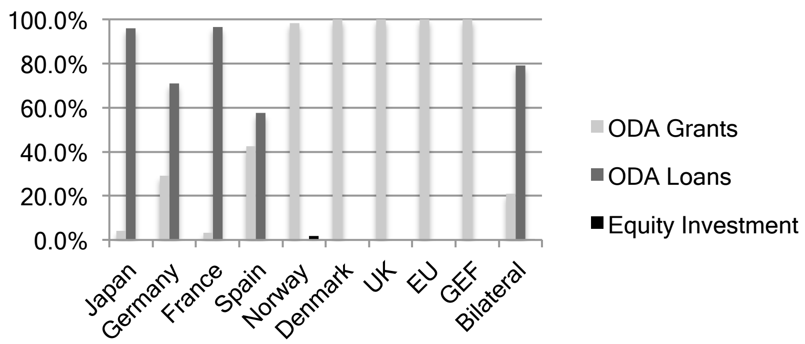
(Figures 4.2, 4.3) provide mitigation finance in this form of concessional loans. Norway and Denmark provide mitigation finance in the form of grants without obligation to repay. Germany and Spain maintain a proportionate balance between loans and grants. Some donors may consider mitigation finance an environmental and economic investment with expected financial returns or other unspecified benefits. Others may view it as a financial instrument with which to fund non-profitable mitigation projects to deal with emissions as by-products of economic activities or negative externalities to which the market has no incentive to respond.

Figure 4.2: Bilateral and multilateral mitigation finance based on type of financial instrument



Note: Bilateral mitigation finance includes all DAC bilateral donors

Figure 4.3: Donors' financial instrument portfolio
(accumulated commitment 1998-2010 in million US$ 2010)



Data sourced from GEF (2013) and OECD (2012a)

Loans are mainly channelled through development banks rather than government ministries. The Japan Bank for International Cooperation (JBIC) and Kreditanstalt für Wiederaufbau (KFW) deliver more than 60% of Japan and Germany's mitigation finance (Table 4.1) to climate projects, including Japan's loan to support the Talimarjan Thermal Power Station Extension Project in Uzbekistan (JICA, 2010). In contrast, a proportion of Norway's mitigation finance is invested in equity, often through buying stocks in private companies. Less than 1% of Norway's mitigation finance is in the form of equity investment. Although mitigation finance ODA invested in equity investment is insignificant, this instrument has received more donor attention due to its ability to catalyse private sector investment in renewable energy (DECC, 2013). Through this equity investment instrument, donors buy part ownership of small or medium enterprises and influence their decision-making to shift its non-climate friendly operations toward climate-compatibility *(ibid*).

Norway intends to mobilise the private sector in emerging economies such as China, India and Brazil in order to finance climate change projects (Bracking *et al*., 2010; Bracking, 2012). Through private equity investment and by acting as a shareholder, Norway can influence companies they invest in to move toward more sustainable development (Whitfield, 2012). As a new ODA scheme, equity investment can be channelled into small- and medium-scale companies or social enterprises with a mission to pursue low-carbon pathways in developing countries (Karmali, 2013).

Table 4.1: Selected agencies to channel mitigation finance
Accumulated commitment 1998-2010 in million US$ 2010 prices

Rank	Japan	Germany	France	Spain	Norway	Denmark	EU	GEFcc
Total listed agencies	6	8	5	15	4	2	2	10
1	JBIC	KFW	AFD	MIE	MFA	MFA	EDF	IBRD
	14387.7	3234.9	3734.6	469.7	1289.4	304.4	840.7	1120.0
	56.5%	67.5%	98.2%	58.9%	71.2%	70.4%	74.6%	49.6%
2	JICA	Federal Ministry	MINEFI	MFA	NORAD	DANIDA	CEC	UNDP
	10259.5	714.6	45.6	174.7	488.8	128.2	286.6	804.0
	40.3%	14.9%	1.2%	21.9%	27.0%	29.6%	25.4%	35.6%
3	MOFA	BMZ	MAE/FSP	ECON	NORFUND			UNEP
	819.8	597.6	12.0	126.1	32.4			135.0
	3.2%	12.5%	0.3%	15.8%	1.8%			6.0%

Data Source: GEF (2013); OECD (2012a)

Notes: Other Japan's agencies, other ministries, MAFF, and PRF (not included) receive an insignificant amount of mitigation finance. GEF data in this table cover mitigation finance given to countries not included in Appendix 1, namely the Czech Republic, Poland, Hungary, Lithuania, Latvia, Romania, the Russian Federation, Bulgaria and the Slovak Republic.

Donors allocate a significant proportion of their loans to the emerging economies of India, Indonesia, China and Vietnam. These countries receive more than 50% of all bilateral mitigation finance commitment (see Table 4.2, the last column). Japan and France primarily allocate their mitigation finance to developing countries with higher per capita income (Tables 4.2 and 4.3). It is possible that they provide concessional loans to stimulate the private sector by executing less-profitable environmental projects, which can be interesting from the perspective of the private sector if there is considerable financial provision at lower interest rates than market interest rates. In particular, the French Development Agency recently committed to investing 50% of its total annual resources to finance climate projects in developing countries, with 30% targeting private development agencies (MAE, 2012).

Unlike Norway's usual ODA allocation strategy, when it comes to mitigation finance the country does not prioritise poorer recipients and allocates only 45.4% of its mitigation finance to lower- and upper-middle-income countries, compared to Japan (85.7%), France (82.3%) and Spain (73.2%).

Table 4.2: The major recipients based on the amount of mitigation finance commitment

Donor	Japan	Germany	France	Spain	Norway	Denmark	EU	GEFcc	Bilateral*
Total recipients	123	86	49	80	76	27	89	143	155
1	India	Bilateral	Indonesia	Tunisia	Bilateral	Egypt	Bilateral	China	India
	7879.4	849.5	733.9	279.4	524.3	75.2	291.1	339.0	8592.8
	30.9%	17.7%	19.3%	35.0%	28.9%	17.4%	25.8%	15.0%	21.2%
2	Indonesia	China	China	Morocco	Brazil	Bilateral	Ukraine	Global	Indonesia
	4682.8	475.5	586.0	138.2	281.7	69.3	107.4	174.0	5667.3
	18.4%	9.9%	15.4%	17.3%	15.6%	16.0%	9.5%	7.7%	14.0%
3	China	India	Morocco	Bilateral	Guyana	China	Tanzania	Mexico	China
	3278.8	421.6	446.3	69.5	248.7	44.9	49.2	167.0	4586.6
	12.9%	8.8%	11.7%	8.7%	13.7%	10.4%	4.4%	7.4%	11.3%
4	Thailand	Brazil	Kenya	Nicaragua	Tanzania	Vietnam	Tunisia	Regional	Bilateral
	1604.0	340.8	282.2	39.3	105.1	42.0	45.3	162.0	3500.1
	6.3%	7.1%	7.4%	4.9%	5.8%	9.7%	4.0%	7.2%	8.6%
5	Vietnam	Egypt	Mexico	Egypt	China	Philippines	Ethiopia	India	Vietnam
	1291.5	251.9	245.0	18.5	75.9	33.4	41.0	141.0	1667.7
	5.1%	5.3%	6.4%	2.3%	4.2%	7.7%	3.6%	6.3%	4.1%
	Unspecified		Unspecified						
	15.5		35.9						
	0.1%		0.9%						

Data Source: GEF (2013); OECD (2012a)

Note: *Includes all bilateral donors. 'Unspecified' is used where a project concerns any combination of recipient countries from different regions or where the recipient country is unknown at the moment of reporting (for example for some aid through NGOs). Projects between a donor and two or more recipient countries are categorised as 'bilateral', and as 'regional' if the recipient countries are located in a same region. Projects whose project locations are not stated potentially due to covering too many countries are categorised as 'unspecified'.

Table 4.3: Distribution of mitigation finance 1998-2010 across income groups (the volume is in million constant 2010 prices)

OECD's country classification based on income level	Japan		Germany		France		Spain		Norway	
	US$	%	US$	%	US$	%	US$	%	US$	%
Least developed countries	1,036.8	4.1%	510.1	10.6%	214.9	5.6%	24.4	3.1%	298.5	16.5%
Other low income countries	2,607.8	10.2%	376.0	7.9%	423.2	11.1%	16.5	2.1%	24.3	1.3%
Lower middle income countries	20,412.6	80.1%	1676.5	35.0%	2,440.9	64.2%	556.2	69.7%	482.8	26.7%
Upper middle income countries	1,302.8	5.1%	1168.6	24.4%	689.5	18.1%	27.6	3.5%	338.4	18.7%
More advanced developing countries	0.1	0.0%	-	0.0%	-	0.0%	-	0.0%	-	0.0%
Part I unallocated by income	125.1	0.5%	1058.6	22.1%	35.9	0.9%	173.1	21.7%	667.3	36.8%
Total	25,485.2	100%	4,789.8	100%	3,804.3	100%	797.8	100%	1,811.3	100.0%

OECD's country classification based on income level	Denmark		UK		EU		GEFcc	
	US$	%	US$	%	US$	%	US$	%
Least developed countries	49.6	11.5%	18.8	1.2%	241.1	21.4%	285.0	16.1%
Other low income countries	63.7	14.7%	3.6	0.2%	50.3	4.5%	105.0	5.9%
Lower middle income countries	201.1	46.5%	66	4.3%	306.7	27.2%	926.0	52.2%
Upper middle income countries	45.2	10.4%	6.9	0.5%	50.2	4.5%	450.0	25.4%
More advanced developing countries	-	0.0%	-	0.0%	-	0.0%	5.8	0.3%
Part I unallocated by income	73	16.9%	1,428.7	93.7%	478.8	42.5%	0.4	0.0%
Total	432.6	100.0%	1,524.0	100.0%	1,127.1	100.0%	1,772.3	100.0%

Data Source: GEF (2013); OECD (2012a)

4.3. Mitigation finance allocation framework

This section discusses a mitigation finance allocation framework adopted from the aid allocation literature. Hoeffler and Outram (2011) categorise aid allocation determinants into recipients' needs, recipients' merits and donors' interests. Recipients' needs include recipients' poverty and development progress; recipients' merits are measured by their governance index and donors' interests by donors' economic, trade and political intentions such as supporting ex-colonies and regional or trade partners.

An adjustment is made to this aid allocation framework to fit the context of mitigation finance. In addition to these three components, mitigation finance also addresses the need to mitigate emissions globally, so mitigation finance has four main elements: global needs (*x1*), recipients' merits (*x2*), recipients' needs (*x3*) and donors' interests (*x4*) (Eq. 1).

$$\textit{Mitigation finance} = f\,(x1, x2, x3, x4) \qquad (1)$$

The next section briefly explains these tested hypotheses and summarises the findings and the selected measurements with the aim of testing the extent to which the effect of these variables differs across the major mitigation finance donors. The main contribution of this chapter is to test several new variables that represent donors' interests. These variables are later explained in more detail.

4.3.1. Global needs

Based on the results presented in the previous section there are four identifiable emission mitigation strategies in developing countries, namely those that address GHG emission level, CO_2 intensity, carbon sink and deforestation rate. These strategies are operationalised, measured and tracked in the effort to prevent increased national aggregate emission levels, slowing down the increasing trend of CO_2 intensity, preserving or enhancing bio-carbon sinks and combating deforestation. To understand how each major donor's allocation of mitigation finance is influenced by these four characteristics, this chapter tests four hypotheses:

H1A: The larger the emissions of a developing country, the greater the likelihood of its being selected to receive mitigation finance and to receive more mitigation finance than other recipients.

H1B: The greater the increasing trend of CO_2 intensity of a developing country, the greater the likelihood of its being selected to receive mitigation finance and to receive more mitigation finance than other recipients.

H1C: The larger the carbon sinks of a developing country, the greater the likelihood of its being selected to receive mitigation finance and to receive more mitigation finance than other recipients.

H1D: The higher the deforestation rate of a developing country, the greater the likelihood of its being selected to receive mitigation finance and to receive more mitigation finance than other recipients.

In the previous chapter a developing country's emission responsibility, measured by the level of CO_2 emissions (*lnco2*), is used to represent its total greenhouse gas emissions; its total forest area (*lnforest*) represents the size of its carbon storage and its deforestation rate represents its loss of carbon sinks. The trend of CO_2 intensity, labelled *rci,* is the ratio of CO_2 emissions generated per GDP in a particular year against its value from the previous period. *rci* is tested separately due to the limited number of observations. Similarly, Marine Protected Areas (MPA), labelled *marine,* was also tested as an alternative to carbon sinks. The previous chapter showed these variables to be significant determinants of mitigation finance.

This chapter tests whether different donors weight these variables differently, e.g. see preventing increasing national aggregate emission levels as preferable to combating deforestation. There was an intention to include dyadic data on transferable commodities with negative impacts on global climate, i.e. coal, based on the hypothesis that donors may consider taking environmental responsibility for their coal consumption and paying for it in the form of mitigation finance. However, there is limited access to dyadic coal trade data, and what exist cover only a few countries, thus the number of observations available is small.

4.3.2. Recipients' merits and needs

In this chapter level of governance and income per capita represent recipients' merits and needs. In the previous chapter these two aspects are statistically significant in influencing the selection and allocation of total mitigation finance from all donors. This chapter includes these aspects in its assessments and tests them as expressed in the hypotheses below:

H2: The better the governance of a developing country, the greater the likelihood of its being selected to receive mitigation finance and to receive more mitigation finance than other recipients.

H3A: The lower the per-capita income of a developing country, the greater the likelihood of its being selected to receive mitigation finance and to receive more mitigation finance than other recipients.

In Chapter 3, good governance in developing countries is appraised by donors and is associated with a greater inflow of mitigation finance. This quality, specifically fulfilling the extensive MRV procedures for mitigation activities, has implicitly become a condition for receiving mitigation finance (Ballesteros *et al.*, 2010). Governance data is taken from the average of WGI, labelled *govern* (Kaufmann *et al*., 2010).

Poorer developing countries may be qualified to receive mitigation finance by the fact that richer developing countries are able to fund or nationally mobilise public and private funds to mitigate climate change without foreign aid. Another explanation is that public mitigation finance is partly taken from development aid, whose objective is to promote recipients' economic development. Thus, as part of development aid, mitigation finance supposedly still conveys a development mission, therefore, economic development is measured by log of per capita income and social development by the infant mortality rate, labelled *lngdppc* and *lninfant*. Infant mortality rate is an important variable that is expected to positively correlate with mitigation finance. The inclusion of this variable in the main specification has been explained in detail in the previous chapter. To investigate the consistency of the parameters in the previous chapter, these variables are tested in turn and it is found to be stable and significant.

H3B: The higher the infant mortality rate of a developing country, the greater the likelihood of its being selected to receive mitigation finance and to receive more mitigation finance than other recipients.

Examining recipients' merits and needs are not the main aim of this chapter, which was the primary focus of Chapter 3. The average governance index from WGI is taken as a proxy for recipients' merits, with both log of per capita income and infant mortality rate are included in the specification, to test the sensitivity of different coefficients of these variables across major mitigation finance donors.

4.3.3. Donors' interests

Examining whether donors' interests influence the allocation of mitigation finance is the key focus and contribution of this chapter, which adds a new element to the broader study of the allocation of mitigation finance. A limited number of studies assess the allocation of private mitigation finance, such as Winkelman *et al.* (2011), who focus on mapping CDM finance across developing countries, and Dolšak and Crandall (2013) who assess the influence of bilateral ties on the allocation of CDM investment across developing countries. This chapter focuses on public mitigation finance and tests whether private investment allocation decisions influence donor governments' decisions about the allocation of official public mitigation finance.

This framework for investigating the potential influence of private investment on donors' decisions is built upon the assumption that besides achieving the normative objectives of mitigation finance, donors potentially benefit politically and economically from mitigation finance transactions that are made by donor countries' private companies to improve donors' economic performance. Donors' gross national income will improve if the private companies originated and registered in their homeland make a considerable return on investment. Some aid studies show that donors' interests are an important determinant of aid (Alesina & Dollar, 2000; Berthelemy, 2006). This also appears to be the case for environmental aid (Figaj, 2010; Hicks *et al.*, 2008). The previous chapter examined mitigation finance in total and therefore cannot test whether any one donor's contribution is affected by its political or economic interests. To the author's knowledge, this empirical quantitative assessment analysing the influence of private investment decision on donor governments' decisions in the allocation of climate finance has never been performed to date and hence this is the major contribution of this chapter to the broader study of climate finance.

As one of the main contributions of this chapter, aspects of donors' interests are tested to investigate:

H4A: The higher the volume of bilateral trade of a developing country with the donor, the greater the likelihood of its being selected for mitigation finance by the donor, and of receiving more mitigation finance from the donor than other recipients.

In addition, donors may benefit by targeting their CDM partners with mitigation finance to expand carbon offset venues (Boyd *et al*., 2007; IFC, 2011). Therefore it is possible that:

H4B: The donor's CDM partners have a greater likelihood of being selected as mitigation finance recipients and of receiving more mitigation finance than other non-CDM partners.

To represent donors' geopolitical interests, this chapter also includes dyadic data on ex-colonial status and the distance between the donor country's capital city and each recipient developing country, following Hicks *et al.*'s (2008) approach. The hypotheses are:

H4C: The donor's ex-colonies have a greater likelihood of being selected as mitigation finance recipients and of receiving more mitigation finance than other non-ex-colonies.

H4D: The closer the recipient to the donor's capital city, the greater the likelihood of being selected to receive mitigation finance and to receive more mitigation finance than more distant recipients.

The ex-colonial status variable is dropped if the donor does not have ex-colonies, such as Norway, and for multilateral donors (except in the case of the EU, where the ex-colonial status of any other EU member state is used). The distance variable is the length in kilometres from the donor's capital city to the recipient's capital city (Mayer & Zignago, 2011). Donors may allocate mitigation finance to neighbouring developing countries for geopolitical purpose, such as strengthening regional partnership, rather than allocate it to distant developing countries whose geopolitical aspects are less relevant to their interests. Distance is measured in logarithm and is dropped in the case of multilateral donors.

Other important variables, namely population, democracy and time dummies are included as control variables. In the case of GEF's environmental aid and the EU's mitigation finance, the log of mitigation finance from all bilateral donors is included in the specification. Villanger (2006) notes that multilateral aid is heavily dependent on how bilateral donors allocate their aid. Another important control variable factor that will improve the rigour of the regression model is a donor's total ODA. This chapter uses the set of variables tested in the previous chapter for a consistent comparative analysis (see summary Table 4.10 at the end of this chapter). This improvement plan will be included when this chapter is presented as a stand-alone paper for publication. The data for each variable are explained further in Table 4.4 and the data sources are presented in Appendix 4.2.

The variables tested are expressed in Eq. (2) below.

$\ln A_{jit} =$

$\beta_0 + \beta_1 \ln CO2_{it} + \beta_2 \ln CS_{it} + \beta_3 \ln DF_{it} + \beta_4 \ln GOV_{it} + \beta_5 \ln GDP_{it} +$

$\beta_6 \ln IM_{it} + \beta_7 \ln POP_{it} + \beta_8 \ln DEM_{it} + \beta_9 CDM_{jit} + \beta_{10} \ln T_{jit} + \beta_{11} COL_{ji} + \beta_{12} \ln D_{ji} + \varepsilon_{it}$ (2)

where A_{jit} is the value of mitigation finance from donor j to developing country i at time t. A_{jit} depends on sets of unilateral and bilateral variables. The unilateral variables, $CO2_{it}, CS_{it}, DF_{it}, GOV_{it}, GDPpc_{it}, IM_{it}, POP_{it}, DEM_{it}$ are respectively CO_2 emission level, the size of carbon sinks, deforestation rate, governance index, per capita income, infant mortality rate, population size, and the level of democracy of developing country i at time t. These variables are identical with the set of variables tested in the previous chapter, which includes a unilateral FDI inflow variable representing donors' economic interests more generally. In this chapter, FDI inflow is replaced by a set of bilateral variables, which represent donors' more specific interests. These bilateral variables, $CDM_{jit}, \ln T_{jit}, COL_{ji}, D_{ji}$ are respectively the dummy of bilateral status of CDM investment of donor *j* in a developing country *i* at time *t*, the total of export and import between donor *j* and a developing country *i* at time *t*, historic colonial status, and the distance in kilometres between the donor *j* and recipient *i*. This specification also includes ε_{it} as the error term.

Two-part model is used to evaluate the determinants used by individual bilateral and multilateral donors. It assumes that there are two stages of mitigation finance distribution: selection and allocation (for more technical information on this model see section 3.3.3). The selection stage employs the general logit model, and the allocation stage strictly applies the simple estimation technique of OLS regression model to only developing countries that receive mitigation finance from a particular donor, dropping non-mitigation finance recipients at this stage.

Table 4.4: Summary statistics 1998-2010

Variable	Variable label	Obs	Mean	SD	Min	Max
Grant	binarygrantcommit	2340	0.435	0.496	0.000	1.000
Loan	binaryloancommit	2340	0.054	0.227	0.000	1.000
Japan	binaryjpncommit	2340	0.199	0.399	0.000	1.000
Germany	binarydeucommit	2340	0.091	0.288	0.000	1.000
France	binaryfracommit	2340	0.030	0.172	0.000	1.000
Spain	binaryespcommit	2340	0.110	0.313	0.000	1.000
Norway	binarynorcommit	2340	0.110	0.313	0.000	1.000
Denmark	binarydencommit	2340	0.033	0.180	0.000	1.000
EU	binaryeuccommit	2340	0.028	0.166	0.000	1.000
GEF mitigation finance	binarygefmcommit	2340	0.216	0.412	0.000	1.000
GEF (all)	binarygefacommit	2340	0.336	0.473	0.000	1.000
Bilateral	binarybilatcommit	2340	0.436	0.496	0.000	1.000
Grant	binarygrantdisburse	2340	0.422	0.494	0.000	1.000
Loan	binaryloandisburse	2340	0.063	0.243	0.000	1.000
Japan	binaryjpndisburse	2340	0.176	0.381	0.000	1.000
Germany	binarydeudisburse	2340	0.113	0.317	0.000	1.000
France	binaryfradisburse	2340	0.044	0.204	0.000	1.000
Spain	binaryespdisburse	2340	0.106	0.308	0.000	1.000
Norway	binarynordisburse	2340	0.092	0.289	0.000	1.000
Denmark	binarydendisburse	2340	0.040	0.195	0.000	1.000
EU	binaryeudisburse	2340	0.061	0.240	0.000	1.000
GEF mitigation finance	binarygefmdisburse	2340	0.336	0.473	0.000	1.000
Bilateral	binarybildisburse	2340	0.418	0.493	0.000	1.000
Grant	lngrantcommit	1019	13.312	2.472	3.059	19.456
Loan	lnloancommit	127	18.371	1.537	14.037	21.685
Japan	lnjpncommit	465	12.666	3.705	3.059	21.616
Germany	lndeucommit	213	14.773	2.350	8.478	19.153
France	lnfracommit	71	15.812	2.503	11.173	19.737
Spain	lnespcommit	258	12.002	2.057	6.538	18.755
Norway	lnnorcommit	258	13.074	2.230	4.439	19.332
Denmark	lndencommit	78	14.150	1.579	10.466	17.890
EU	lneuccommit	66	15.144	1.574	10.884	18.361
GEF mitigation finance	lngefmcommit	506	13.721	1.765	10.823	17.710
GEF (all)	lngefacommit	787	14.231	1.597	9.210	18.283
Bilateral	lnbilatcommit	1021	13.656	2.928	3.059	21.700
Grant	lngrantdisburse	987	12.997	2.128	6.016	19.414
Loan	lnloandisburse	148	16.207	2.451	9.540	20.706
Japan	lnjpndisburse	413	12.759	3.235	5.670	20.592
Germany	lndeudisburse	265	13.597	2.045	7.640	18.257
France	lnfradisburse	102	13.687	2.539	10.395	19.318
Spain	lnespdisburse	249	12.105	2.118	6.538	18.737
Norway	lnnordisburse	215	12.862	2.090	4.439	19.290
Denmark	lndendisburse	93	12.946	1.575	7.856	17.516
EU	lneudisburse	143	12.549	1.791	7.544	17.098
GEF (all)	lngefmdisburse	787	14.448	1.554	9.903	18.769
Bilateral	lnbildisburse	977	13.334	2.518	6.016	20.715

Developing countries' emissions responsibility	lnco2	1910	8.601	2.405	2.686	15.855
	rci	739	122.661	119.408	2.797	1303.553
	lnforest	1820	6.956	3.025	-1.204	13.221
	marine	1650	4.432	10.002	0.000	75.360
	deforest	2244	1.094	0.618	0.010	2.320
Policy performance	govern	1764	-0.306	0.755	-2.480	1.531
Development aspects	lngdppc	1738	7.197	1.563	-0.036	11.394
	lninfant	2015	3.379	0.890	0.742	4.988
Population	lnpop	2158	15.165	2.238	9.141	21.014
FDI inflow	fdiinflow	1976	4.980	8.298	-37.616	167.383
Democracy	democracy	1658	1.928	6.407	-10.000	10.000
Japan	lnjpntrade	1738	7.218	0.931	0.303	8.417
Germany	lndeutrade	1738	6.847	1.388	-0.421	8.589
France	lnfratrade	1738	7.296	0.692	-0.583	8.824
Spain	lnesptrade	1738	7.189	0.754	0.083	8.324
Norway	lnnortrade	1738	6.801	1.328	-1.045	8.473
Denmark	lndentrade	1738	7.158	0.753	0.313	8.886
Japan	jpncdm	2340	0.039	0.193	0.000	1.000
Germany	deucdm	2340	0.024	0.153	0.000	1.000
France	fracdm	2340	0.021	0.142	0.000	1.000
Spain	espcdm	2340	0.026	0.159	0.000	1.000
Norway	norcdm	2340	0.015	0.123	0.000	1.000
Denmark	dencdm	2340	0.013	0.114	0.000	1.000
DAC	dacxcolony	2340	0.589	0.492	0.000	1.000
Japan	jpnxcolony	2249	0.035	0.183	0.000	1.000
Germany	deuxcolony	2249	0.052	0.222	0.000	1.000
France	fraxcolony	2249	0.185	0.388	0.000	1.000
Spain	espxcolony	2249	0.127	0.333	0.000	1.000
Norway	norxcolony	2249	0.000	0.000	0.000	0.000
Denmark	denxcolony	2249	0.000	0.000	0.000	0.000
EU	eucxcolony	2249	0.832	0.374	0.000	1.000
Japan	lnjpndistance	2249	9.127	0.514	7.053	9.830
Germany	lndeudistance	2249	8.748	0.627	6.585	9.711
France	lnfradistance	2249	8.762	0.588	6.873	9.738
Spain	lnespdistance	2249	8.739	0.626	6.210	9.788
Norway	lnnordistance	2249	8.825	0.512	7.104	9.661
Denmark	lndendistance	2249	8.782	0.575	6.885	9.689

4.4. Heterogeneity of determinants across eight donors of mitigation finance

This section highlights the determinants that influence the allocation of mitigation finance by eight major donors (Japan, Germany, France, Spain, Norway, Denmark, GEF, and EU institutions). Clist's (2011) study of total ODA and Figaj's (2010) study of environmental aid show the heterogeneity in preferences across donors where the determinants of allocation of overall ODA and environmental aid are varied across donors. It is likely that this heterogeneity of parameters and measurements also occurs in the allocation of mitigation finance. For example, donor A, which allocates all mitigation finance to deforestation projects, uses the size of carbon sinks and deforestation rates as determinants, while donor B, which allocates all mitigation finance to energy efficiency projects, refers to CO_2 emission level and CO_2 intensity.

The discussion starts with determinants used to commit to and disburse mitigation finance and then compares these two measures of aid. The discussion focuses on analysing the consistency of coefficient sign of the determinants in the selection and allocation stages of each phase.

4.4.1. Commitments of eight major mitigation finance donors

Table 4.5 shows each donor weights differently the determinants – global needs, recipients' performance and needs and donors' interests – indicating that the eight major mitigation finance donors have different priorities when they commit to allocating mitigation finance. GEF environmental aid is added to the discussion to provide a comparison with determinants used for the allocation of funds with a wider range of environmental objectives.

Global needs

At the commitment phase of the selection stage there is early evidence that bilateral donors make their decisions based on developing countries' CO_2 emission levels. The *lnco2* determinant is significant, at 5% (Table 4.5, c9) in the assessment of total bilateral mitigation finance commitment, showing that the total amount of mitigation finance committed by both major and minor mitigation finance donors is determined by developing countries' CO_2 emission levels. For eight major mitigation finance donors, *lnco2* is an insignificant determinant. This lack of evidence at the commitment phase is consistent with the results presented in the previous chapter, which find inconsistent application of *lnco2* as a determinant of global official mitigation finance, *ceteris paribus.*

Table 4.5: Selection stage: mitigation finance commitment by individual donors

	Japan	Germany	France	Spain	Norway	Denmark	EU	GEFcc	GEF	Bilateral
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8a)	(8b)	(9)
lnco2	0.197	0.072	-0.049	0.046	0.196	0.298	-0.320	-0.033	-0.063	0.189**
	(1.556)	(0.558)	(-0.199)	(0.339)	(1.393)	(1.254)	(-1.000)	(-0.269)	(-0.417)	(1.977)
lnforest	0.157***	0.171***	0.150	0.042	0.216***	-0.049	0.112	0.034	0.064	0.208***
	(2.906)	(2.748)	(1.194)	(0.498)	(3.535)	(-0.524)	(0.809)	(0.550)	(1.096)	(5.144)
deforest	-0.029	0.163	0.389	-0.033	0.012	0.157	-0.066	0.029	0.127	-0.032
	(-0.347)	(1.430)	(1.627)	(-0.386)	(0.125)	(1.161)	(-0.399)	(0.279)	(1.534)	(-0.559)
govern	0.557**	1.206***	1.123*	0.881***	1.232***	2.096***	0.519	0.580*	0.817***	0.969***
	(2.302)	(3.747)	(1.831)	(2.582)	(4.768)	(4.794)	(0.978)	(1.958)	(2.738)	(4.329)
lngdppc	-0.385**	-0.293*	0.394	-0.110	-1.145***	-1.054***	0.224	0.022	-0.194	-0.437***
	(-2.070)	(-1.852)	(1.260)	(-0.544)	(-6.486)	(-3.071)	(0.502)	(0.130)	(-0.934)	(-3.456)
lninfant	-0.172	0.283	0.843**	0.413*	-0.422	0.303	0.420	0.122	-0.005	0.352*
	(-0.709)	(1.270)	(2.198)	(1.895)	(-1.613)	(0.813)	(0.960)	(0.528)	(-0.022)	(1.926)
lnpop	0.312**	0.431**	0.561*	0.386**	0.211	0.376	0.454	0.427***	0.345*	0.227*
	(2.030)	(2.400)	(1.744)	(2.048)	(1.171)	(1.227)	(1.015)	(2.613)	(1.727)	(1.830)
fdiinflow	-0.014	0.017	0.028	0.046***	0.020	-0.023	0.035	-0.003	0.008	0.011
	(-0.737)	(0.962)	(1.023)	(3.362)	(1.318)	(-0.667)	(1.122)	(-0.168)	(0.355)	(0.523)
democracy	0.051***	0.022	-0.003	-0.004	-0.027	-0.108***	-0.050	-0.004	0.017	0.051***
	(2.630)	(1.010)	(-0.062)	(-0.131)	(-1.348)	(-3.249)	(-1.381)	(-0.198)	(0.850)	(3.345)
lndyadtrade	0.236	-0.013	-0.105	0.347*	0.224	-0.175				
	(1.467)	(-0.120)	(-0.218)	(1.650)	(1.480)	(-0.831)				
dyadcdm	1.292***	0.579	0.344	1.026**	0.124	0.197				
	(3.101)	(1.310)	(0.414)	(2.326)	(0.272)	(0.286)				
dyadxcolony		-0.724	1.355**	3.878***			-0.017	-0.150	0.065*	-0.418**
		(-0.710)	(2.377)	(9.925)			(-0.032)	(-0.706)	(1.743)	(-2.351)
lndistance	-1.312***	-0.517***	-1.020***	-1.567***	-0.373	1.785***				
	(-5.118)	(-2.582)	(-2.856)	(-7.439)	(-1.438)	(3.067)				
lnbilcom							0.092	0.042	-0.071	
							(1.174)	(1.167)	(-0.302)	
χ^2	.	130.8	1246.5	185.3	150.2	632.2	1416.5	76.5	4038.9	257.7
P-values	.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	945	1057	848	952	1057	954	469	632	590	1064

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively. All data are commitment except GEF data which indicated the amount funding of approved projects.

Some donors are more committed than others to providing mitigation finance to developing countries with larger forest areas. At the selection stage the coefficients of *lnforest* are positive and significant for Japan (c1), Germany (c2) and Norway (c5) at 1%.

At the allocation stage (Table 4.6), the only statistically significant relationship between aid and *lnco2* is GEF environmental aid - significant at 5%, *ceteris paribus* (c17b). The CO_2 emissions variable appears to be significant and explains the allocation of environmental aid more broadly. Interestingly, there is lack of evidence that this variable determines GEF's mitigation finance (c17a). The GEF uses the Global Environment Benefit for climate change (GBIcc) formula to allocate mitigation finance across developing countries, with absolute GHG emissions as one of the determinants of its allocation. This chapter does not particularly measure GHG emissions, instead, similar to the study in the previous chapter, it uses CO_2 emissions that is the main and largest component of GHG emissions due to limited data on other greenhouse gasses. This chapter shows that there is a lack of evidence that GHG emissions determine the allocation of GEF mitigation finance. Although the GHG variable has substantial weight in the GBIcc formula, it is possible that in practice other factors, such as institutional performance and project performance, also have a strong influence on the allocation of GEF's mitigation finance. Details of GEF's climate change fund allocation framework are discussed in the next section.

Table 4.6: Allocation stage: mitigation finance commitment by individual donors

	Japan (10)	Germany (11)	France (12)	Spain (13)	Norway (14)	Denmark (15)	EU (16)	GEFcc (17a)	GEF (17b)	Bilateral (18)
lnco2	0.341	0.008	-1.437	0.308	-0.053	-0.458	0.223	0.121	0.176**	0.108
	(1.113)	(0.033)	(-1.669)	(1.240)	(-0.240)	(-1.204)	(0.545)	(0.885)	(1.983)	(0.753)
lnforest	0.034	-0.065	-0.776*	-0.021	0.288**	-0.178	-0.107	-0.017	0.107**	0.073
	(0.299)	(-0.534)	(-1.822)	(-0.206)	(2.033)	(-0.968)	(-0.679)	(-0.295)	(2.467)	(1.143)
deforest	0.494***	-0.110	0.257	0.008	-0.072	0.494**	0.332	-0.037	0.077	0.299***
	(3.163)	(-0.733)	(0.233)	(0.038)	(-0.504)	(2.138)	(1.160)	(-0.438)	(1.143)	(3.285)
govern	1.047*	0.228	0.180	-0.266	0.565	-0.411	0.592	0.527*	0.378*	1.231***
	(1.949)	(0.442)	(0.086)	(-0.554)	(0.824)	(-0.540)	(0.797)	(1.950)	(1.918)	(4.259)
lngdppc	-1.051**	0.008	2.263*	-0.843**	0.079	1.219**	-0.810	-0.111	-0.132	-0.483***
	(-2.379)	(0.024)	(1.979)	(-2.493)	(0.231)	(2.042)	(-1.491)	(-0.621)	(-0.923)	(-2.593)
lninfant	-0.024	0.189	0.803	-0.427	1.241***	0.297	-0.371	-0.158	0.004	-0.144
	(-0.051)	(0.402)	(0.520)	(-0.917)	(2.766)	(0.617)	(-0.398)	(-0.779)	(0.022)	(-0.571)
lnpop	0.394	0.348	2.905**	-0.164	0.191	0.664	0.124	0.342*	0.154	0.647***
	(1.040)	(1.062)	(2.709)	(-0.586)	(0.635)	(1.300)	(0.226)	(1.764)	(1.237)	(3.585)
fdiinflow	-0.007	0.077	0.042	-0.014	-0.005	0.165*	0.026	0.052**	-0.004	0.047***
	(-0.163)	(1.556)	(0.559)	(-0.738)	(-0.180)	(1.711)	(0.416)	(2.312)	(-0.261)	(2.758)
democracy	0.044	0.012	0.007	-0.093*	0.016	-0.005	0.020	0.002	-0.009	0.002
	(1.240)	(0.350)	(0.055)	(-1.954)	(0.425)	(-0.132)	(0.359)	(0.126)	(-0.684)	(0.111)
lndyadtrade	0.361	0.353	-0.255	0.548	0.079	0.583				
	(1.458)	(1.543)	(-0.234)	(1.420)	(0.314)	(1.351)				
dyadcdm	0.877	0.728	0.543	0.164	1.518*	-1.198*				
	(1.574)	(1.204)	(0.268)	(0.332)	(1.876)	(-1.723)				
dyadxcolony		0.790	0.028	0.524			0.053	0.061	-0.133	-0.141
		(0.917)	(0.016)	(1.059)			(0.043)	(0.289)	(-0.843)	(-0.582)
lndistance	-0.914**	-0.229	0.607	0.121	-1.936***	1.167				
	(-2.233)	(-0.610)	(0.522)	(0.333)	(-4.083)	(1.322)				
lnbilcom							0.019	0.036	-0.010	
							(0.168)	(1.009)	(-0.342)	
R^2	0.338	0.442	0.596	0.323	0.287	0.342	0.768	0.455	0.305	0.272
Adjusted R^2	0.296	0.328	0.085	0.210	0.171	0.022	0.520	0.392	0.267	0.249
P-values	0.000	0.328	0.085	0.000	0.000	0.238	0.520	0.000	0.000	0.000
N	321	131	35	148	151	59	32	196	353	632

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

Norway is the only donor that consistently uses *lnforest* as a positive determinant when selecting developing countries to receive its mitigation finance (c5) and when allocating how much mitigation finance should its recipients get (c14). Norway has shown its leadership to fund large scale forestry projects in many developing countries such as in Indonesia (Moe *et al*., 2013a; Nakhooda & Fransen, 2013). GEF only apply *lnforest* as a determinant to decide how much environmental aid recipients should receive (c17b). Deforestation rate is only used by Japan and Denmark to decide the amount of mitigation finance given to recipients – their coefficients of *deforest* are positive and significant at 1% and 5% respectively (c10, c15). Some donors choose to allocate their mitigation finance to a collaborative deforestation project such as REDD+ through the International Climate Forests rather than engage in bilateral transfers (Nakhooda & Fransen, 2013).

Recipients' performance and needs

At the selection stage, governance is a more important determinant of mitigation finance for individual bilateral donors than for multilateral donors except for the EU, whose coefficient of *govern* is statistically insignificant (Table 4.5, c7). Among bilateral donors, it appears that Denmark's allocation of mitigation finance is much more sensitive to governance than Japan's. For Denmark, the coefficient of the governance variable (*govern*) (c6) is 2.096 and significant at 1%. This figure is much greater than Japan's *govern* (c1), 0.557, significant at 5%. This diverging view of the importance of good governance as the determinant of mitigation finance allocation can be associated with donors' financial instruments. Figure 1B shows that Japan's mitigation finance is primarily loans, while Denmark primarily provides grants. Compared to loans, in the absence of good governance grants can be prone to corruption (Knack, 2013; Svensson, 2000a). Although studies of overall ODA show that aid is more effective in an environment with good policies, good governance can be a secondary pre-condition of effective mitigation finance allocation, whose objectives can be attained through different priority sectors and financial instruments.

The results show that Japan, Germany, Norway and Denmark deliberately support developing countries with a lower per capita income. Their coefficients of *lngdppc* are negative and significant (Table 4.5, c1, c2, c5, c6). On the other hand, France and Spain tend to prioritise the social development of developing countries – *lninfant* is positive and significant at 10% (c3, c4). For France and Spain social development is more important than economic development; *lngdppc* is not statistically significant.

The application of these two determinants of income per capita and infant mortality varies across donors. In the allocation stage, France and Spain's *lninfant* are insignificant (c12, c13). France, Norway and Denmark's *lngdppc* are positive (c12, c14, c15); however, Norway's *lngdppc* is insignificant. The positive coefficients of *lngdppc* contradict the negative coefficients of all bilateral donors' *lngdppc* at the allocation stage (c18). Perhaps this variation in the application of *lngdppc* and *lnifant* is due to a relatively high correlation between GDP and infant mortality and because these countries suffer from limited numbers of observations – France (c12) and Denmark (c15) only have respectively 35 and 59 observations.

Governance is an important indicator in Japan's decisions on which recipients to give more mitigation finance to. Its coefficient of governance is 1.047, statistically significant at 10% (c10), much higher than GEF mitigation finance 0.527 (c17a) and GEF environmental aid 0.378 (c17b) (significant at 10%). This information adds more detailed specificities to the earlier findings on the two financial instruments. At the allocation stage Japan, a loan-oriented donor, views good governance as more important in the allocation of mitigation finance than does GEF, a grant-oriented donor. For another grant oriented donor, like Denmark, governance is important in selection stage but not in the allocation stage.

Donors' interests

The results in Table 4.5 indicate that there is evidence of donors' intention to co-benefit economically from mitigation finance transactions. Japan and Spain seem interested in providing mitigation finance to their CDM partners rather than non-CDM partners, with a positive and significant CDM partner variable (*dyadcdm*) at 1% and 5% respectively at the selection stage of the commitment phase (c1, c4). This is clearer in the case of Japan, which has a stronger interest in mobilising the private sector by financing climate-change projects (Whitley, 2012). Little is known about Spain's motives to have public finance inflow following private sectors' green investments in Spain's CDM partners.

In addition to the donors' interest in investing in their CDM partners, mitigation finance may also convey their political agenda. Ex-colonies and neighbouring countries are prioritised for mitigation finance. Like development aid more broadly, mitigation finance can be used as a political instrument to strengthen regional cooperation. France and Spain tend to choose their ex-colonies as recipients – the *dyadexcolony* variable is positive, significant and consistent in the commitment phase of the selection stage (c3, c4). However, being an ex-colony does not qualify a country to receive larger amounts of mitigation finance. The coefficient of *dyadexcolony* is insignificant at the allocation stage.

Distance is also a determinant for Japan, Germany, France, and Spain's mitigation finance recipients. These countries choose developing countries that are close by; *lndistance* is negative and significant. Generating mitigation finance from auction revenues from the EU Emissions Trading System (ETS) (Harmeling *et al.*, 2013, p. 5), Germany prioritises developing countries within the EU and EU's and/or countries bordering Germany, which may offer EU countries stronger economic and trade benefits and show how mitigation finance can enhance regionalism.

At the allocation stage, Japan privileges its export-import partners with more mitigation finance commitment than its non-trading partners (Table 4.6, c10). There is an opportunity here for Japan to promote its new clean technologies to its mitigation finance recipients and in return, to build trade relationships and receive more continuous supplies of raw commodities from them. Interestingly, Norway selects developing countries put forward by Norway's private investment in offsetting carbon emissions through CDM. Berthelemy's study (2005, cited in Canavire *et al*., 2005) finds the country tends to perform as an altruistic donor in allocating overall ODA; he shows that its aid is allocated to developing countries with no strong trade relationship indicating its less export-related self-interest. The consistent statistically significant estimation of the relationship between Norway's mitigation finance and CDM location at allocation stage of the commitment phase show that Norway's mitigation finance is influenced by the location selected for its private investment. Norway tends to give more funds to recipient countries that host CDM projects funded by its private sector (significant at 10%; see c14). This indicates Norway's allocation strategy to strengthen its recipients' capacity to effectively join the carbon trading in the near future, while Denmark counterbalances its private actors' investment by providing countries other than CDM destinations with higher volume of mitigation finance – *dyadcdm* is negative and significant at 10% (c15) than if the recipient countries that host CDM projects.

4.4.2. Disbursements of eight major mitigation finance donors

The disbursement phase is further discussed below to verify whether determinants representing global needs, recipients' needs and performance and donors' interests are used consistently compared to their use in the commitment phase.

Global needs

At the actual selection stage, the statistical significance of the emissions variable representing global needs varies across donors. CO_2 emissions have become an essential determinant of mitigation finance for Japan, Norway and Denmark. These donors select developing countries with greater emissions as their recipients: for all three, *lnco2* is positive and significant, with Norway at 1% (c23) and Japan's and Denmark's at 5% (c19, c24). The results show that EU tends to provide grants to developing countries with fewer emissions, having a consistently negative *lnco2* (c25). This reflects the EU's consistent implementation of its strategic decision. It has made a strategic partnership with African, Caribbean, and Pacific (ACP) states, formally set out in the Cotonou Partnership Agreement (EU, 2005). These are non-industrial developing countries which tend to produce a low level of emissions. The Cotonou

Agreement regulates the specificities of the EU's financial allocation framework, which is explained in detail in the next section.

Table 4.7: Selection stage: mitigation finance disbursement by individual donors

	Japan (19)	Germany (20)	France (21)	Spain (22)	Norway (23)	Denmark (24)	EU (25)	GEF (26)	Bilateral (27)
lnco2	0.366**	0.129	0.071	-0.102	0.702***	0.623**	-0.644**	-0.063	0.094
	(2.402)	(0.926)	(0.286)	(-0.717)	(4.316)	(2.570)	(-2.322)	(-0.417)	(0.960)
lnforest	0.147**	0.198***	0.502***	0.055	0.300***	-0.001	0.154	0.064	0.251***
	(2.484)	(3.602)	(4.085)	(0.662)	(3.753)	(-0.008)	(1.271)	(1.096)	(5.903)
deforest	0.033	0.489***	0.615***	0.063	0.056	0.092	-0.193	0.127	0.048
	(0.318)	(4.285)	(3.028)	(0.718)	(0.444)	(0.730)	(-1.501)	(1.534)	(0.732)
govern	0.768***	1.758***	1.320**	0.473	1.260***	2.382***	0.207	0.817***	1.094***
	(2.804)	(5.685)	(2.388)	(1.377)	(3.727)	(5.311)	(0.405)	(2.738)	(4.650)
lngdppc	-0.728***	-0.662***	0.591**	0.074	-1.651***	-1.655***	0.148	-0.194	-0.341***
	(-3.194)	(-3.684)	(2.197)	(0.366)	(-7.177)	(-4.391)	(0.401)	(-0.934)	(-2.629)
lninfant	-0.180	0.409*	1.212***	0.366	0.102	-0.126	-0.634	-0.005	0.552***
	(-0.683)	(1.724)	(3.165)	(1.600)	(0.328)	(-0.357)	(-1.573)	(-0.022)	(2.956)
lnpop	0.123	0.291	0.480	0.569***	-0.165	0.041	0.923**	0.345*	0.308**
	(0.681)	(1.640)	(1.492)	(2.909)	(-0.791)	(0.143)	(2.471)	(1.727)	(2.528)
fdiinflow	-0.026	-0.017	0.048**	0.037**	0.001	-0.037	-0.006	0.008	0.006
	(-1.091)	(-0.845)	(2.358)	(2.518)	(0.036)	(-1.055)	(-0.156)	(0.355)	(0.432)
democracy	0.058***	0.016	-0.063*	0.007	-0.017	-0.113***	-0.058*	0.017	0.038**
	(2.725)	(0.741)	(-1.672)	(0.273)	(-0.742)	(-3.220)	(-1.710)	(0.850)	(2.563)
lndyadtrade	0.264	0.051	0.364	0.245	0.251	-0.013			
	(1.602)	(0.484)	(0.924)	(1.139)	(1.434)	(-0.054)			
dyadcdm	1.085***	0.833	-0.125	0.827**	0.647	-0.185			
	(2.709)	(1.467)	(-0.198)	(2.024)	(1.158)	(-0.276)			
dyadxcolony		-2.030**	1.571***	3.546***			0.355	-0.071	-0.407**
		(-2.113)	(3.610)	(9.137)			(0.702)	(-0.302)	(-2.260)
lndistance	-1.421***	-0.457**	-1.456***	-1.467***	-0.089	1.732***			
	(-5.320)	(-2.357)	(-5.241)	(-6.713)	(-0.297)	(3.003)			
lnbildis							0.030	0.065*	
							(0.456)	(1.743)	
χ^2	1549.0	2015.1	1076.3	2821.5	337.2	320.2	.	4038.9	273.7
P-values	0.000	0.000	0.000	0.000	0.000	0.000	.	0.000	0.000
N	945	1057	954	952	848	850	543	590	1064

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

Providing mitigation finance to forested developing countries has been the central interest of Japan (c19), Germany (c20), France (c21), and Norway (c23). Germany's and France's *deforest* are positive and significant at 1%. These results indicate that these donors tend to provide mitigation finance for densely-forested developing countries to fund deforestation projects such as those of REDD+ (Moe *et al*., 2013b).

Recipients' performance and needs

For the selection stage, I use disbursement data, governance (*govern*) representing the institutional performance of developing countries. The coefficients of *govern* in all columns in Table 4.7, except in c25, show the stable signs and consistent statistical significance compared to the results of this determinant of mitigation finance using commitment data in Table 4.5. As in the commitment phase of the selection stage, all the donors except the EU (c7 and c25) apply good governance as a determinant of mitigation finance except the coefficient of Spain (c22) that becomes statistically significant.

In its allocation of mitigation finance Denmark appreciates developing countries' good governance more than other donors: its *govern* coefficient, at 2.382 (Table 4.7, c24), is almost threefold that of Japan at 0.768 (c19). This demonstrates Denmark's consistent appreciation of good governance. Japan is less stringent than Denmark in using policy performance as a determinant of mitigation finance, but is more consistent than Denmark in using policy performance across both the selection and the allocation stages.

Most of the mitigation finance donors have similar views and prefer to give mitigation finance to developing countries that are poor in terms of per capita income. At the selection stage (see Table 4.7), the coefficients of *lngdppc* for Japan (c19), Germany (c20), Norway (c23), and Denmark (c24) are negative and significant at 1%, while France provides mitigation finance for developing countries with higher per capita income (positive and significant *lngdppc* at 1%).

There are two possible explanations for the positive correlation of France's mitigation finance allocation with both *lngdppc* and *lninfant* (Table 4.7, c21). First, France may support countries where income per capita is high and there are social development problems such as poor health care and high infant mortality rate. Although income per capita usually has a high negative correlation with infant mortality rate – a country with high per capita income has low infant mortality – in some countries it is possible that both infant mortality (representing social problems) and income per capita are high. For example, a small part of the population may harness and benefit from a large part of the country's income while the majority of the population still lives in poor social conditions. Second, both coefficients of *lngdppc* and *lninfant* are positive potentially because of the existence of multicollinearity between *lngdppc* and *lninfant.* When these variables are tested in turn they are stable and significant (see Appendix 4.4). *lninfant* is still positive and significant at 5% (c62), and without *lninfant, lngdppc* remains positive and significant at 5% (c61).

At the allocation stage only Japan and GEF, with more observations than the other donors, have significant and positive coefficients for *govern* (Table 4.8, c28, c35). The number of observations tends to influence statistical significance and the robustness of the estimation. As in the disbursement phase of the allocation stage, there is lack of evidence that per capita income and the infant mortality rate are determinants of mitigation finance, *ceteris paribus*. This may be caused by an insufficient number of observations. However, the majority of the coefficient signs of *lngdppc* are consistently negative, except in the cases of France (c30), Norway (c32) and Denmark (c33). Limited numbers of observations impact on the results' ability to create robust estimations.

Table 4.8: Allocation stage: mitigation finance disbursement by individual donors

	Japan (28)	Germany (29)	France (30)	Spain (31)	Norway (32)	Denmark (33)	EU (34)	GEFcc (35)	Bilateral (36)
lnco2	0.366	0.120	-0.506	0.198	-0.172	-0.029	1.026*	0.138	0.288**
	(1.262)	(0.702)	(-0.738)	(0.730)	(-0.482)	(-0.069)	(1.952)	(1.465)	(1.994)
lnforest	-0.006	-0.124	-0.822**	-0.021	0.138	-0.064	0.275	0.104**	0.088*
	(-0.058)	(-1.460)	(-2.037)	(-0.211)	(1.017)	(-0.244)	(1.134)	(2.246)	(1.702)
deforest	0.268**	-0.064	-1.056*	-0.057	0.190	0.105	-0.148	0.063	0.256***
	(2.056)	(-0.447)	(-1.958)	(-0.251)	(0.979)	(0.434)	(-0.586)	(0.907)	(3.405)
govern	0.962**	0.240	-0.562	0.273	0.819	0.466	0.169	0.441**	1.086***
	(2.048)	(0.618)	(-0.373)	(0.431)	(1.455)	(0.478)	(0.222)	(2.064)	(4.586)
lngdppc	-0.801**	-0.350	1.771	-0.678*	0.207	0.123	-2.129**	-0.064	-0.733***
	(-1.998)	(-1.429)	(1.431)	(-1.842)	(0.378)	(0.184)	(-2.581)	(-0.428)	(-3.905)
lninfant	0.030	0.022	-0.665	-0.495	0.495	0.553	-1.586*	0.107	-0.375*
	(0.063)	(0.059)	(-0.567)	(-0.940)	(1.279)	(1.501)	(-1.768)	(0.595)	(-1.749)
lnpop	0.453	0.371*	1.727	0.017	0.295	0.264	-1.150	0.184	0.380**
	(1.301)	(1.730)	(1.632)	(0.051)	(0.646)	(0.467)	(-1.642)	(1.425)	(2.047)
fdiinflow	0.006	-0.020	0.001	0.005	0.054	0.018	-0.068	-0.004	0.011
	(0.123)	(-0.472)	(0.034)	(0.152)	(1.227)	(0.220)	(-0.976)	(-0.222)	(0.510)
democracy	0.090***	0.001	-0.072	-0.101**	0.037	-0.006	-0.068	-0.013	0.010
	(2.973)	(0.041)	(-1.220)	(-2.006)	(0.858)	(-0.135)	(-1.111)	(-0.968)	(0.568)
lndyadtrade	0.125	0.090	-0.465	0.041	0.470	-0.167			
	(0.689)	(0.446)	(-0.300)	(0.119)	(1.657)	(-0.406)			
dyadcdm	0.183	0.123	0.724	0.382	1.433**	0.471			
	(0.350)	(0.263)	(0.632)	(0.881)	(2.032)	(0.667)			
dyadxcolony		-1.216**	1.217	0.815		1.257	0.845	-0.146	0.017
		(-2.053)	(0.850)	(1.587)		(1.038)	(1.073)	(-0.916)	(0.080)
lndistance	-1.686***	-0.178	0.271	-0.134	-0.834				
	(-4.085)	(-0.674)	(0.251)	(-0.365)	(-1.639)				
lnbildis							-0.111	0.026	
							(-0.921)	(0.759)	
R^2	0.440	0.318	0.525	0.310	0.218	0.170	0.386	0.297	0.331
Adjusted R^2	0.398	0.219	0.298	0.201	0.087	-0.112	0.087	0.260	0.309
P-values	0.000	0.219	0.000	0.000	0.000	-0.112	0.087	0.000	0.000
N	278	167	63	147	127	72	53	353	601

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

Donors' interests

At the selection stage, Spain's mitigation finance is moving in the same direction as its private investment in CDM host countries. Spain's *dyadcdm* is significant at 5% (Table 4.7, c22). Japan also persistently following private investment in CDM host countries as mitigation finance recipients in the commitment phase (Table 4.5, c1) as well as in the disbursement phase (Table 4.7, c19).

Ex-colonies of France and Spain are prioritised to receive France and Spain's mitigation finance (Table 4.7, c21, c22). However, Spain expresses a stronger preference than France, with Spain's beta coefficient of *dyadexcolony* (3.546) much bigger than France's (1.571). Japan, Germany, France, and Spain (c19-22) also prefer to choose neighbouring countries as mitigation finance recipients. Their coefficients for *lndistance* are negative and significant at 1%, indicating their support for neighbouring countries, while Denmark (c33) tends to provide mitigation finance to countries that are further away – *lndistance* is positive (c24).

Some results of estimation from the allocation stage suffer from the small number of observations (See N in Table 4.8). Nevertheless, Norway, as a pro-development donor, still has *dyadcdm* positive and significant at 5% (c32), showing its persistence in following its private investment and providing recipient countries which also CDM host countries. At the allocation stage, Japan shows its interest in supporting regional cooperation by providing more mitigation finance to recipient countries that are close by (Table 4.8, c28). In the aggregate level, main variables *lnforest*, *govern*, *lngdppc*, *lninfant*, and *lnpop*, determine bilateral mitigation finance disbursement at both the selection and the allocation stage (Table 4.7, c27 and Table 4.8, c36).

4.4.3. *From commitment to disbursement: a rhetoric-reality gap*

The use of determinants in the allocation of mitigation finance in the commitment and disbursement phases tends to vary, signalling that there is a gap between donors' rhetoric and their actual allocation. The statistical significance and the sensitivity of the coefficients of determinants indicate the extent of donors' consistency in using the same determinant to decide on their allocation when they make provisional financial commitment as opposed to when they actually have to deploy the funding. This section identifies inconsistencies and discusses the possible rationale behind them.

The emission variable, *lnco2,* draws several donors' attention more seriously at the disbursement stage. Japan, Norway and Denmark use it as a positive determinant when making actual decisions on which country receives mitigation finance and but do not use it when making provisional commitment. Their coefficients of *lnco2* are positive and statistically significant at the minimum 5% level (Table 4.7, c19, c23, c24) but statistically insignificant at the commitment phase. Potentially several donors avoid using *lnco2* as the determinant in the commitment phase, possibly because of the restrictive ODA principles which emphasise improving economic development and the livelihood of the poor. Using *lnco2* as the determinant when selecting recipient countries is likely to shift further away ODA from poor developing countries to the countries with more advanced industries and economic development where opportunities of reducing emissions are abundant.

In the absence of a penalty for failing to fulfil their commitment, donors have room to adjust their determinants of allocation, especially when some programmes for reducing CO_2 emissions in high-emitting countries are ready for funding sooner than others, which take longer to develop in developing countries that are less ready for the large-scale reduction of their emissions (Cerbu *et al.* 2011; Halimanjaya, 2014). It is also worth noting that Japan's considerable contribution to total global mitigation finance may have a major influence on how it is allocated.

Unlike Japan, the EU's *lnco2* is consistently negative and is statistically significant in the disbursement phase (Table 4.8, c34). Support for mitigation action in non-industrialised developing countries seems to be consistent with the EU's Cotonou Agreement (EU, 2010). The aspiration to improve the economies of African and Caribbean Pacific countries, which are mainly non-industrialised and less developed, also aligns with ODA principles. While providing mitigation finance to poor countries agrees with ODA principles, one may argue that the EU's mitigation finance may not target large-scale emission reduction effectively.

Spain's governance (*govern*) is insignificant in the selection stage of the disbursement phase (Table 4.7, c22), while it is positive and strongly significant at 1% in the selection stage of the commitment phase (Table 4.5, c4). Using good governance as the determinant in the commitment phase can be considered a form of safeguarding for effective mitigation finance. Where host mitigation projects are supported by a good policy environment, the implementation of the project can achieve its intended outcomes faster.

At the disbursement stage, Spain's attention to allocate more mitigation finance to poorer developing countries is less than at the commitment stage. The coefficient of Spain's *lngdppc* in Table 4.6 (-0.843) is lower than its *lngdppc* (-0.678) at the commitment stage in Table 4.8. This indicates that Spain commits itself to allocating more mitigation finance to poorer countries, but when it comes to disbursement, more money is in fact allocated to the richer countries among these poorest recipients. Here in the allocation at disbursement stage, global emissions becomes secondary to Spain's political and economic agenda to support ex-colonies, neighbouring countries and its own private-sector investment in designated countries: its *dyadxcolony* *lndistance,* and *dyadcdm* are positive and statistically significant at 5% and 1% (Table 4.7, c22).

Norway's *lninfant* is insignificant in the disbursement phase (Table 4.8, c32), but significant in the commitment phase (Table 4.6, c14). The social development of the poor is no longer the priority: the allocation of private-sector investment across developing countries is becoming a stronger influence on Norwegian public mitigation finance. The coefficient of Norway's *dyadcdm* is even higher in the disbursement stage; it is only significant at 10% in the commitment phase (Table 4.6, c14) and is becoming significant at 5% in the disbursement phase (Table 4.8, c32).

The variable of *lndistance* of Japan (Table 4.6, c28) at the allocation stage of the disbursement phase is twice as sensitive as in the commitment phase (c10). The negative sign suggests that its neighbouring countries offer economic and political opportunities such as trade cooperation and tend to receive more mitigation finance from Japan. Norway behaves in a similar way in the commitment phase but disregards this distance variable in the allocation of its disbursement. Norway's *lndistance* is insignificant in the allocation at the disbursement stage (Table 4.8, c32), but is strongly significant at 1% in the allocation at the commitment stage (Table 4.6, c14).

In general, the heterogeneity of determinants of mitigation finance distribution across developing countries is more apparent in the commitment phase, indicating that there are few shared or common allocation policies among mitigation finance donors. This finding both supports and opposes Villanger's (2006) argument that bilateral donors do not share a strategic foreign policy. The disbursement phase shows more homogenous determinants in use. The similarities among major mitigation finance donor determinants may be explained by a herding effect that encourages other mitigation finance donors to invest in multi-donor projects to mitigate the risk of project failure due to lack of continuity in disbursement caused by an economic downturn in a particular donor country.

4.5. Grants vs loans

This section investigates whether different sets of parameters are used to distribute two types of mitigation finance instrument: grants and loans. Donors provide grants without expecting recipients to repay them, and loans or concessional loans for repayment after a certain period; the latter have low interest rates and an additional grace payback period (OECD, 2014).

This section covers mitigation finance grants and loans from 23 DAC donors and EU institutions to 180 developing countries in 1998-2010. GEF mitigation finance is not included due to its different categorisation of data (i.e. GEF uses 'project approved', rather than 'amount committed' and 'amount disbursed'). Although GEF environmental aid data taken from OECD's DAC include commitment and disbursement, they do not exclusively specify mitigation finance or funds allocated to climate-change mitigation projects.

Due to the inherent risk of mitigation finance becoming a perverse incentive such that it can promote recipients' continuation of inefficient energy consumption practices in order to receive mitigation finance, it is also possible that the allocation of mitigation finance grants and loans have different sets of underlying driving factors. For example, loans are given to small and large sized enterprises in developing countries with emerging economies, in the form of concessional loans with interest rates below market rates to replace fossil-fuel machineries with energy efficient technologies. On the other hand grants are given to developing countries with sizable carbon sinks and a high rate of deforestation to fund afforestation projects, which are unlikely to generate any profit or financial return.

The analysis starts with the parameters when allocating grants, followed by an analysis of those used to allocate loans. Each analysis consists of two elements, commitment and disbursement, and each of these in turn involves two stages, selection and allocation. The first aim of this section is to identify whether there is the same set of parameters are used in the selection and allocation stages of mitigation finance grants and loans. The second is to compare the differences between the two instruments.

4.5.1. Mitigation finance grants

Table 4.9 shows that the allocation of mitigation finance grants and loans is determined by two different climate-related variables. Mitigation finance grants (hereafter 'grants') tend to be determined by *lnforest*, a variable that represents recipient countries' capacity for mitigating global emissions via reforestation or reducing forest degradation. In the commitment phase of the selection, there is an early sign that developing countries with high levels of emissions receive donors' commitment in the form of grant - *lnco2* is positive and significant at 10% (c37). However, this determinant becomes insignificant in the allocation of mitigation finance grant (c38) and mitigation finance disbursement (c39, c40). The emissions variable (*lnco2)* seems to be an insignificant determinant of grant mitigation finance when the variable of trend of carbon intensity, *rci*, is included having all signs of other variables remain significantly stable and consistent (Appendix 4.3, Table 4.11, c45-c48).

Developing countries with larger forested areas tend to receive bigger grants. *lnforest* is positive and significant at 1% (c37). In the same phase at the allocation stage, similar results indicate that mitigation finance recipients with larger forest areas tend to receive bigger grants, with *lnforest* positive and significant at 1% (c38). In the disbursement phase of grant allocation, *lnforest* (significant at 1%) seems to be applied more consistently as a determinant of mitigation finance (c39, c40).

Developing countries' deforestation rate is not rated as important determinant in the allocation of mitigation finance grants. There is lack of evidence that the severity of problem related to deforestation is addressed more systematically such that recipients with a higher deforestation rate qualify for a larger amount of mitigation finance. On the other hand, MPAs as an alternative sink are a significant determinant of grants. Developing countries with larger percentage of MPAs from their total territorial waters tend to receive grants – *marine* is positive and significant at 1% (Appendix 4.3, Table 4.12, c53-56). MPAs which is associated with blue carbon (Mcleod *et al.*, 2011) is an insignificant determinant of mitigation finance loans (c57-c60).

Table 4.9: Determinants of grant and loan mitigation finance

	Grant				Loan			
	Commitment		Disbursement		Commitment		Disbursement	
	Selection	Allocation	Selection	Allocation	Selection	Allocation	Selection	Allocation
	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)
lnco2	0.157*	-0.070	0.068	0.065	0.445***	0.700*	0.658***	0.563
	(1.683)	(-0.545)	(0.694)	(0.525)	(3.004)	(1.828)	(3.626)	(1.645)
lnforest	0.221***	0.169***	0.304***	0.135***	-0.027	-0.010	-0.069	0.116
	(5.416)	(3.000)	(6.906)	(3.033)	(-0.403)	(-0.158)	(-1.155)	(0.759)
deforest	-0.039	0.113	0.019	0.085	0.556***	-0.200	0.560***	-0.140
	(-0.670)	(1.495)	(0.291)	(1.423)	(3.892)	(-1.332)	(4.904)	(-0.573)
govern	0.999***	1.008***	1.102***	0.839***	0.703**	-0.235	0.995***	1.265
	(4.479)	(4.006)	(4.671)	(3.975)	(2.011)	(-0.405)	(2.877)	(1.285)
lngdppc	-0.421***	-0.349**	-0.336**	-0.475***	-0.554***	-0.933*	-1.084***	-0.985**
	(-3.379)	(-2.129)	(-2.574)	(-3.004)	(-3.007)	(-1.935)	(-4.316)	(-2.078)
lninfant	0.341*	-0.173	0.470**	-0.359**	0.136	-0.670	0.114	-1.341***
	(1.879)	(-0.807)	(2.523)	(-2.036)	(0.477)	(-1.530)	(0.346)	(-3.304)
lnpop	0.234*	0.482***	0.257**	0.352**	0.412**	-0.356	0.158	0.139
	(1.916)	(2.930)	(2.083)	(2.218)	(2.085)	(-0.759)	(0.673)	(0.358)
fdiinflow	0.012	0.037**	0.008	0.023	0.046***	-0.098	0.011	-0.016
	(0.563)	(2.377)	(0.514)	(1.166)	(3.292)	(-1.649)	(0.444)	(-0.336)
democracy	0.045***	-0.012	0.031**	-0.001	0.044	-0.001	0.066***	0.009
	(2.997)	(-0.634)	(2.040)	(-0.088)	(1.643)	(-0.039)	(2.770)	(0.234)
xcolony	-0.393**	-0.190	-0.296	-0.122	0.122	0.159	-0.153	0.790
	(-2.211)	(-0.911)	(-1.630)	(-0.688)	(0.405)	(0.512)	(-0.529)	(1.533)
χ^2	255.5		294.9		135.6		1234.0	
R^2		0.220		0.270		0.603		0.520
Adjusted R^2		0.196		0.246		0.487		0.426
P-values	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	1064	624	1064	597	1064	85	1064	111

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

Recipients' policy performance, represented by good governance, appears to be a strong determinant of receiving grants. Good policy performance becomes a condition for developing countries to receive grants and to receive more grants. Donors pledge their commitment to giving grants to developing countries with better governance than the others; *govern* is positive and significant at 1%. This seems to be a consistent practice in the disbursement of grants.

Grant-oriented donors tend not to allocate more grants to recipients with higher economic need. In the commitment phase, donors favour providing more mitigation grants to developing countries with higher per-capita income – i.e. the sensitivity of the coefficients of the *lngdppc* variable of the mitigation grant is less than at both the selection and the allocation stage (Table 4.9, c37-c38). This coefficient appears to be more sensitive in the disbursement of mitigation loans (c39, c40, as discussed in the next section, which specifically compares mitigation loans with mitigation grants.

Grants are also positively correlated with infant mortality at the selection stages of both the commitment and disbursement phases - *lninfant* is positive and significant at 1% (Table 4.9, c37, c39). Unexpectedly, in the disbursement phase of the allocation stage, *lninfant* becomes a negative parameter for grants. Perhaps at this stage social development comes after the principal objective of mitigating emissions, and therefore recipients with lower infant mortality but offering better mitigation potential, i.e. larger forest area, receive more in grants.

Population is also a determinant of grants, although there is an indication of small-country bias. The coefficients of *lnpop* are lower than 1, which means that to a small extent donors tend to qualify developing countries with larger populations; however, smaller countries tend to receive more aid per capita. The allocation of mitigation finance overall shows that democratic countries are given preferential treatment: they tend to be selected as grant recipients at both the commitment and the disbursement stage, with *democracy* significant and positive at 1%. Democracy as a parameter of mitigation finance allocation is consistent with good governance, whose presence in a country promotes its good use of such funding.

4.5.2. Mitigation finance loans

Mitigation finance loans (hereafter 'loans') appear to be allocated to developing countries with a sizable quantity of emissions. In the commitment phase of the selection stage, developing countries with a higher level of emissions consistently tend to receive loans. *lnco2* is positive and significant at 5% (Table 4.9, c41), indicating that recipients with larger emissions are more likely to receive loans. However, the statistical significance of *lnco2* (10%) is not as strong as it is at the selection stage. When the trend of carbon intensity, *rci,* is included, *lnco2* in the selection stage (c41, c43) remains statistically significant (Appendix 4.3, Table 4.11, c49, c51). A robustness check using HSM shows a stronger relationship between *lnco2* and mitigation finance loan than grant (Appendix 4.3, Table 4.14, c66-c67). In all estimations of mitigation finance loans using the alternative model, the coefficient of *lnco2* is statistically significant.

A similar pattern is found in the disbursement of loans. *lnco2* tends to be a strong determinant at the selection stage, being significant at 1% (Table 4.9, c43). No evidence is found at the allocation stage, with insignificant *lnco2* (c44). Importantly, this shows that recipients with higher emissions do not qualify and incentivise recipients for more loans.

An interesting finding is that there is no evidence that donors provide loans to developing countries with larger forest areas – i.e. *lnforest* is insignificant in all cases of loans (Table 4.9, c41-c44). However, deforestation rate appears to be a strong determinant in qualifying developing countries as mitigation finance borrowers, with *deforest* positive and significant at 1% in the commitment and disbursement phases (c41, c43). The commercial opportunities provided by reforestation projects as opposed to deforestation are less obvious; in fact many deforestation activities are the negative externalities of the commercial activities of the coal extraction and palm oil industries (Abood *et al.*, 2014). Public finance like ODA can play a role in funding initiatives to restore forests, which are destroyed as the result of global market failure to address its negative externalities.

Another interesting finding is that concessional loans are given to poorer developing countries. The coefficients of *lngdppc* of mitigation loans in columns 43 and 44 are more sensitive than those of mitigation grants (c39 and c40). Poorer developing countries potentially lack of capital and can often need capital lending to address an increasingly pressing climate change issue that may also impair the national economy, such as continuous floods and prolonged drought. Although mitigation loans can facilitate poor developing countries' transition towards low-carbon economic growth (Myhrvold & Caldeira, 2012), it is questionable whether providing loans to these countries, which are less able to repay them than poor non-industrial developing countries, leads to economic improvement or deepens public debt and hampers their economy in the short term.

Population (*lnpop*) is statistically insignificant; it does not influence donors' decisions about allocating mitigation loans to developing countries. It is possible that the selection of developing countries receiving mitigation finance largely depends on developing countries' economic activity rather the size of the population, which does not indicate their ability and capacity to repay debt.

It is important to point out that the number of observations of disbursed loans is higher than that of committed loans. In Table 4.9 there are 111 observations of the former and only 85 of the latter. One explanation is that some financial disbursement is recorded without recorded commitment. In some of Japan's projects the amount committed is not recorded but sizable disbursed amounts are. Economic stability is a major concern if a recipient country is not given sufficient time to anticipate a large sum of foreign financial inflow, where this practice happens frequently.

There is a carefully systematic selection of financial instrument to avoid rewarding developing countries with higher emissions with grants. Instead, they tend to receive loans. Grants are directed to developing countries with sizable forest areas or higher deforestation rates, conceivably to reduce their emissions through improved forestry management. The consequence is that the allocation of public mitigation finance may deviate from the original intention to respond to the Copenhagen Accord's article 7, which aims to promote development pathways in economies with low emissions if *lnco2* is used as a positive determinant of loans and if there is an increasing share of mitigation loans from total climate finance.

More consideration is given to recipients' performance when providing grants than when offering loans. Perhaps loans are offered more generously in the commitment phase, since donors charge interest rates and require paybacks. The coefficient of *govern* for loans is positive and significant at 5% (0.703) (Table 4.9, c41) in the commitment phase, less than for grants (0.999) (c37). In the disbursement stage, *govern* has similar influence when donors select countries to receive grants. There is little difference between the coefficients of *govern* for grants (1.102) (c39) and for loans (0.995) (c43) at the selection stage.

Loan-oriented donors tend to use progress in social development as a negative determinant of the distribution of loans. Nevertheless, they pay considerable attention to the economic aspect of recipients' needs. Poorer developing countries with lower per capita income tend to be more successful at attracting loans, as *lngdppc* is negative and significant at 1% at the selection stage of the commitment phase (c41). However, *lninfant,* significant at 1%, seems to be a negative determinant of the provision of loans at the allocation stage (c44). Donors may avoid giving loans to recipients with severe social development problems, which can be associated with a greater possibility of defaulting on repayments.

From understanding the determinants of mitigation finance instruments, this study shows donors in overall are more interested in providing loans to developing countries with a sizable emissions and grants to the countries with sizable forest areas.

4.6. GEF's and EU's resource allocation frameworks

This section discusses the resource allocation frameworks used by GEF and the EU to distribute their mitigation finance. The emphasis is on analysing specific features, criteria and parameters of their frameworks for allocating mitigation finance across developing countries for the mitigation of climate change.

4.6.1. GEF System for Transparent Allocation of Resources (STAR)

GEF has introduced the GEF-5 STAR to replace the GEF-4 Resource Allocation Framework (RAF) (GEF, 2005a; 2010; 2011). These frameworks operate guide GEF's decisions about which developing countries should receive climate finance. GEF does not specify the amount of funding designated for mitigation and adaptation. A review of the GEF by Nakhooda (2013) notes that so far its climate finance primarily supports efforts to promote the uptake of energy-efficient and low-carbon technologies. A quarter of the GEF funding portfolio is allocated to strengthening the institutional capacity of recipient countries. Therefore in this chapter, GEF's climate finance is referred as mitigation finance. The STAR framework generates a country score of three elements with different weights, as seen in Eq. (3).

$$Country\ score = GBI^{0.8} \times GPI^{1.0} \times GDP^{-0.04} \tag{3}$$

The GPI (GEF Performance Index), which represents a country's performance based on the GEF evaluation system, has slightly a higher weight than the GBI (Global Benefit Index). Performance is almost as important as the potential environmental global impact of a developing country. GDP, signifying global economic significance and a country's economic activity, is weighted as a negative determinant, which to a small extent increases the GEF STAR score of a developing country with a lower GDP. The components and weights in the GEF country score formula are determined and considered after a series of consultations with GEF Council members who have the right to put forward motions to update and change them (GEF, 2005b). This discussion is relevant to reviews of the formula of GEF with the aim of improving the effectiveness of GEF resource allocation.

GEF sets individual allocation frameworks for all three thematic windows, namely biodiversity (GBIbd), land degradation (GBIld), and climate change (GBIcc). The latter is calculated as shown in Eq. (4)

$$GBI_{cc} = 0.95\left(GHG_{2007}\times\frac{(CO_2/GDP)_{1990}}{(CO_2/GDP)_{2007}}\right) + 0.05\left(FC_{2005}\times\frac{DF_{1990-2000}}{DF_{2000-2005}}\right) \quad (4)$$

The GBIcc score indicates a country's contribution to emission reduction by controlling emission levels and preserving bio-carbon sinks or forests. More generally, the higher the GBIcc score a country has, the higher its potential for receiving GEF's mitigation finance grants and receiving larger sums.

GHG emissions and trend of CO_2 intensity $\left(GHG_{2007}\times\frac{(CO_2/GDP)_{1990}}{(CO_2/GDP)_{2007}}\right)$ have a large share in GBIcc. This component comprises 95% of total GBIcc in two parts. The first part of GBIcc prioritises developing countries with large carbon emissions (represented by $GHG_{2007,}$ consisting of CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, all measured in tons of CO_2e); the larger the 2007 GHG emissions emitted by a developing country, the more the country qualifies to receive more GEF mitigation finance. The second part incentivises a developing country to or rewards it for reducing its CO_2 intensity, represented by $\frac{(CO_2/GDP)_{1990}}{(CO_2/GDP)_{2007}}$. This country will have a higher score if it can demonstrate a significant reduction of CO_2 intensity in 2007 against its 1990 CO_2 intensity. For example, if in 2007 country A is able to reduce its 1990 CO_2 intensity by half, it will double its 2007 GHG emissions score and increases its GBIcc score.

A small weighting of 5% is given to the GBIcc's second element, which measures a developing country's mitigation potential via forestry. This second element $\left(FC_{2005} \times \frac{DF_{1990-2000}}{DF_{2000-2005}}\right)$ also consists of two parts and has a logic similar to that of the first element of GBIcc. The first part prioritises developing countries with vast forest cover (FC) or natural carbon sinks that keep CO_2 emissions from being released into the atmosphere. The second part incentivises the country to reduce its deforestation rate. GEF uses the average of the annual 1990-2000 deforestation rate (DF) against that of 2000-2005. Although GEF incentives countries with forest or natural environmental capacity to reduce emissions, the 5% weighting given to this second part of the equation can only increase a country's GEF STAR score to a small extent, even if it has been able to reduce its deforestation rate significantly.

Chapters 3 and 4 in this thesis test elements in the GEF STAR GBIcc in Eq. (3). This thesis tests *lnco2, rci, lnforest* and *deforest* to represent the GBIcc elements GHG_{2007}, $\frac{(CO_2/GDP)_{1990}}{(CO_2/GDP)_{2007}}$, FC_{2005} and $\frac{DF_{1990-2000}}{DF_{2000-2005}}$, respectively. In these chapters these elements are not weighted and CO_2 intensity (*rci*) is calculated in a slightly different way. It is measured by a country's CO_2 intensity compared to its previous year's record. Instead of using 2005's forest cover data, FC_{2005}, and the ratio of the changing deforestation rate from 1990 to 2000 divided by the changing deforestation rate from 2000 to 2005, $\frac{DF_{1990-2000}}{DF_{2000-2005}}$, in the studies presented in chapters 3 and 4, *deforest* measures average annual change of forest from the FAO forest data in 1990, 2000, 2005, and 2010. One of considerations is due to a lack of scientific ground which year is acceptable for use as the base year.

GEF weighs and values heavily emissions-related than forest-related components, implying that GEF assumes that mitigation via energy efficiency is more effective and produces greater global benefit than mitigation by reducing deforestation and forest degradation. GEF assigns only 5% to forest-related components based on the argument that currently there is no robust methodology to quantify carbon stocks (GEF, 2011, p. 9).

Secondly, GEF uses a base year, i.e. 2007 for GHG and 2005 for FC, abstracting from the variation over time. One may argue that emissions vary considerably according to economic activity (Peters *et al*., 2012). However, for forest-related components a base year may not have a substantial effect as it varies much less (with a tendency to decline) than the economic performance of a country (Stibig *et al.*, 2013). One of the implications of using a static base year is that developing countries with low economic performance in 2007 associated with lower emissions in that year are undervalued in terms of their potential contribution to reducing global emissions until GEF updates its base year.

Performance, the other element of STAR, is measured using the GEF Performance Index (GPI). GPI consists of three weighted components: the portfolio performance indicator (PPI), which carries the least weight, the country environmental policy and institutional assessment indicator (CEPIA), and the broad framework indicator (BFI) as shown in Eq. (5).

$$GPI = 0.65(CEPIA) + 0.15(BFI) + 0.2(PPI) \quad (5)$$

CEPIA, the largest weighted component (see Eq. 5), is taken from the eleventh criterion in the policies for social inclusion equity cluster of the World Bank's Country Policy and Institutional Assessment (CPIA), whose measurements emphasise the environmental sustainability of policies and institutions (WB, 2011, p. 36). The Assessment covers crosscutting issues in two categories; the institutional context and environmental themes. The institutional context covers access to information, public participation, the quality and effectiveness of the EA system, cross-sectoral coordination, and accountability (*ibid*). The latter category centres on policy, implementation and enforcement with nine environmental themes: air pollution, water pollution, waste, freshwater resources, marine and coastal resources, ecosystem and biodiversity, commercial renewable resources, non-renewable resources, and climate change (*ibid*). The measurement of each CPIA criterion ranges from 1 to 6 (the highest and most desirable). The CPIA document (WB, 2011) explains the conditions to be met for each range by each recorded developing country, but there is a lack of transparency as the CEPIA World Bank's Country Policy is not accessible by the general public.

BFI, the broad framework indicator is taken from the World Bank's IDA Resource Allocation Index (IRAI20). It is the average of five CPIA indicators under the heading Public Sector Management and Institutions, which consists of property rights and rule-based governance, quality of budget and financial management, effectiveness of revenue mobilisation, quality of public administration, transparency, accountability, and corruption in the public sector (GEF, 2010, p. 21). This also ranges from 1-6, with 6 and the highest. 2008 data for 75 IDA countries are available (WB, 2008).

The underlying assumption when using BFI is that it can generate a measurement which can be used as a benchmark to compare developing countries according to its public sector management and institutional performance. The data are gathered annually and reviewed by an independent external panel selected and assigned by the World Bank (GEF, 2010, p. 20). Little is known of the criteria set by the World Bank for selecting the panel.

All projects funded by the GEF are evaluated twice, once during implementation and again as the end of the project approaches. The component PPI shown in Eq. (6) consists of two weighted elements resulting from this evaluation process: progress ratings of project implementation reports (PIR) and terminal evaluation reports (TER), whose results provide a better indication of the overall achievement of project's objective and hence are given a slightly higher weight compared to the results of PIR, which provide only a partial picture of the project' achievement.

$$PPI = 0.4(PIR) + 0.6(TER) \tag{6}$$

Both PIR and TER elements are specific project features, which are important to motivate project managers to deliver good results. However the total contribution of these two elements is weighted much less than macro performance indicators. Eq. (5) shows that a country's performance is determined largely by macro indicators (CEPIA and BFI), while overall project performance (PPI) only has 20% of share in the total GEF performance index (GPI). It is possible that this project performance component has little weighting due to the element of subjectivity in project evaluation. Projects can be assessed by different evaluators who have different views and interpretations of their performance.

The GEF performance indicator consists of elements that may be unrelated. Broader measurements of country's performance indicators (BFI) potentially have any link and direct relevance to a country's project performance. In the latter case, when a developing countries' general policy performance is good but it fails to demonstrate good project performance, based on the GEF performance index this country is likely to qualify and be prioritised for aid from GEF, although the score will be slightly negatively affected by the low project performance score.

With a weighting of only 20% for performance (PPI), GEF may not sufficiently incentivise recipient governments' national authorities to perform well in delivering projects. There is a conceivable danger of having a series of projects with poor performance, as project performance has less effect on the allocation of funding than the countries' general policy performance.

For the GDP Index, GEF selects -0.04 as the value of the exponential power. With this negative value, the lower the GDP per capita of a country, the higher the GDPI score of the country, and this country with higher GDPI score will be eligible for a higher allocation of funding inflow from the GEF. It is intentionally set to shift resources from richer to poorer countries (GEF, 2010, p. 22); the drawback of the GDP Index is that it does not capture the vulnerability of small-island developing countries, which can have high GDP per capita and small populations. Although GEF clarifies the drawback of its GDP Index there is no systematic explanation for why -0.04 is a preferable value of the exponential power of the GDP index than, for example, -0.1 and -0.01.

There is an additional drawback from the GEF's higher-level body's reliance on project reports written by local or regional project managers. Using project reports as a criteria of aid allocation may create a tendency for managers to overstate the results in hopes of receiving more funding, such as by claiming both cross-cutting mitigation and adaptation objectives when a project is not intended to accommodate both. If the result of the assessment is heavily dependant only on the project reports the results of the assessment may not represent the real performance of the projects.

In general there are two main concerns related to the GEF STAR. First, with its little weighting for performance, the system does not encourage project managers to work towards better performance. It has a lack of determinant that is able to incentivise for both project managers and the country to adhere to the global objective of GEF to mitigating climate change. If project leaders drift the objective away to less relevant objectives, e.g. providing more local benefits using GEF mitigation grant that is intended to bring more global benefits, their actions are unlikely to affect the probability of projects continuously receiving grants from GEF in the future.

Secondly, the transparency of GEF STAR is limited. GEF STAR explains the PPI assessment process and how GEF normatively allocates its mitigation finance. However, public access to several components of GEF's GBIcc like PPI is restricted. Hence it is difficult for external parties to verify the GEF's resource allocation to developing countries by replicating the calculation of the GEF STAR score for each developing country.

These two concerns add to a possibility of GEF moving away from implementing GEF STAR. Marcoux and Tierney (2011) make an analysis using principal-agent theory to analyse the implication of ways and actions from GEF's institutional arrangement. As a mitigation finance grant-giver, GEF and its strategic actions, including the allocation of its resources, depend on its collective principals (the GEF Council), which approve both policies and individual projects. Marcoux and Tierney (2011) observe that the outcomes of its arrangement remain puzzling and intriguing. To date there is a lack of evidence on whether the GEF Council fully adheres to the GEF STAR when it approves projects. There is a possibility that the actual allocation of GEF resources deviating from its normative guidance (GEF STAR). It is possible for donors, using their control over their financial resource disbursement, to influence the GEF Council to approve projects based on donors' preferences, which might not be fully aligned with the GEF STAR. Without transparent project performance it is difficult to minimise any risk of diversion or reallocation of GEF mitigation finance from its STAR and from its primary objective to mitigating global emissions.

4.6.2. EU's multinannual financial framework

In 2000, the EU established a comprehensive formal partnership agreement with developing countries and in particular with the African, Carribean and Pacific (ACP) countries through the so-called Cotonou Agreement, revised in 2005 and in 2010. The 2005 version adds an EU multiannual financial framework for the period 2008 to 2013 (EU, 2010). In

2013, the CONCORD Cotonou working group convened to discuss a necessary step towards the ratification of the new Economic Partnership Agreement following on from its predecessor, the Cotonou agreement. Some African countries taking part in this agreement, namely Botswana, Burundi, Cameroon, the Comoros, Ivory Coast, Fiji, Ghana, Haiti, Kenya, Lesotho, Mozambique, Namibia, Rwanda, Swaziland, Tanzania, Uganda and Zambia need to take necessary action before October 1 2014 in order to be included in the partnership and retain their access to EU market. Until then, the current Cotonou agreement still affects each participating country.

Most of the articles relating to climate change were only added in 2010, including article 32a, which explains the EU's approach to addressing climate change (see Appendix 4.4). The agreement does not have a resource allocation formula as the GEF's GBIcc. Instead, the Cotonou Agreement, particularly the preamble, annexes and Article 32a, are the main guiding principles for how the EU allocates its financial resources to address climate change.

With the amended preamble to the Cotonou Agreement in 2005 and 2010 its current version acknowledges that climate change negatively affect the most vulnerable populations, particularly in least developed countries and small island ACP countries. This preamble indicates that the EU's prime concern related to climate change has been inserted into the agreement more recently and has added weight to the adaptation aspect, which is concerned with helping vulnerable communities in LDCs and small island countries with the negative effects of climate change.

The results of the empirical assessment in this chapter, presented in section 4.4, reflect some of the features of the EU's commitment in the Cotonou Agreement and explain the extent of the EU's actual allocation of resources against the normative statement expressed in the Agreement. As stated in the Agreement, the EU commits to prioritising non-industrial ACP countries as its recipients. Presumably non-industrial countries have low carbon emissions, the EU commitment to support and to prioritise ACP countries is reflected by the negative and statistically significant CO_2 emissions (*lnco2*) of the EU mitigation finance (Table 4.7, c25). The evidence presented in this thesis verifies that 'non-industrial' features as one of the determinants of the EU's selection criteria. The result of the EU's disbursement at the allocation stage (Table 4.8, c34) also reveals that among non-industrial ACP countries, CO_2 emissions are used to determine which ACP countries qualify to receive more EU mitigation finance.

Article 32a of the Cotonou Agreement specifies the determinants to be used for EU resource allocation. First, the EU selects ACP countries as recipients, hence other developing countries may have limited access to EU aid. Second, the EU recognises the competing objectives and financial constraints to funding climate change and other development projects which may threaten the achievement of the MDGs. This will further restrict the allocation of funding to climate projects whose objectives do not contribute to achieving the MDGs. Third, the emphasis is on improving institutional development and capacity building in response to the threat posed by climate change (Appendix 4.4, Art. 32A,b). This article may also be linked to the EU's aim of enhancing the participation of ACP countries in the global carbon market (*ibid,* Art. 32c). The climate change project activities that the EU recognises relate to mainstreaming poverty reduction with climate change through policy dialogue and assistance in the agriculture, water management, infrastructure, forestry, weather forecasting, and clean energy sectors.

The annexes explain several features of the EU's financing mechanism, including further details of EU resource allocation. Annex IV, Article 3 states that EU resource allocation criteria consider and include recipients' needs and performance. The needs are measured by *'…per capita income, population size, social indicators and level of indebtedness and vulnerability to exogenous shocks'* (Art 3.1a). Recipients' performance is measured by:

> *'…governance, progress in implementing institutional reforms, country performance in the use of resources, effective implementation of current operations, poverty alleviation or reduction, progress towards achieving the Millennium Development Goals, sustainable development measures and macroeconomic and sectoral policy performance'* (Art 3.1b).

Annex II, art. 1.3 clarifies the availability of two financing instruments – loans and grants – and the reduction of 3% interest of loan for private sector development in certain country groups (Annex II art 2.7a). The EU allows its aid to be invested as equity in the private sector, including in financial institutions (art.2.1ai). Here, the EU's aid may be directed towards stimulating and mobilising a larger scale of financing that is primarily driven by and originates from the private sector. There are also eligibility criteria for additional resources in the case of short-term fluctuations in export earnings (Annex II, art. 9), as for all EU aid.

Both the GEF and the EU's allocation frameworks serve as guiding principles. Compared to GEF, the EU's financial allocation framework is described in more detailed but is less structured and less transparent, with no reference to which datasets are used for the assessment of recipients' needs and performance and how they are assessed. In the case of GEF, the weighting assigned to each component tends to reduce the subjectivity of country assessment in allocating resources, although there is lack of evidence if the actual practice of EU or GEF resource allocation adheres to these guiding principles.

To sum up, Table 4.10 recapitulates all the donors' mitigation finance determinants, based on their official statements and the empirical analysis presented here and in Chapter 3. A comparison of these allocation frameworks shows that some donors choose determinants on the basis of strategy and their belief about what constitute effective measures for mitigating global emissions, improving the economic development of developing countries and benefit from mitigation finance transactions.

Table 4.10: Summary of determinants of mitigation finance across donors

Variable	Label	Aggregate commitment		Aggregate disbursement		Grant commitment		Grant disbursement		Loan commitment		Loan disbursement		EU's commitment		EU's commitment		EU Cotonou	GEF's commitment		GEF's commitment		GEF-5 STAR
		Selection	Allocation	Selection	Allocation	Selection	Allocation	Selection	Allocation	Selection	Allocation	Selection	Allocation	Selection	Allocation	Selection	Allocation		Selection	Allocation	Selection	Allocation	
Emissions	lnco2				+					+	+	+				-				+			+
Carbon intensity	rci	+	+	+	+					+													+
Carbon storage	lnforest	+	+	+	+	+	+	+	+	+	+	+	+						+	+	+		+
Deforestation	deforest	+	+	+	+	+	+	+	+	+	+	+	+					+	+		+	+	+
Performance	govern	+	+	+	+	+	+	+	+	+	+	+	+					+	+	+	+	+	+
Income per capita	lngdppc	-	-		-	-	-	-	-	-	-	-	-				-	-					-
Infant mortality	lninfant			+	-	+		+	-				-										
Population	lnpop	+	+	+	+	+	+	+	+	+						+		+	+		+		
FDI inflow	fdiinflow		+				+			+													
Democracy	democracy	+		+							+												
Colonial status	xcolony																						
Volume of trade	lndyadtrade																						
CDM partner	dyadcdm																						
Regionalism	lndistance																						

Variable	Label	Japan's commitment Selection	Japan's commitment Allocation	Japan's Disbursement Selection	Japan's Disbursement Allocation	Germany's commitment Selection	Germany's commitment Allocation	Germany's Disbursement Selection	Germany's Disbursement Allocation	France's commitment Selection	France's commitment Allocation	France's Disbursement Selection	France's Disbursement Allocation	Spain's commitment Selection	Spain's commitment Allocation	Spain's Disbursement Selection	Spain's Disbursement Allocation	Norway's commitment Selection	Norway's commitment Allocation	Norway's Disbursement Selection	Norway's Disbursement Allocation	Denmark's commitment Selection	Denmark's commitment Allocation	Denmark's commitment Selection	Denmark's commitment Allocation
Emissions	lnco2			+																+				+	
Carbon intensity	rci																								
Carbon storage	lnforest	+		+		+		+			-	+						+	+	+	+				
Deforestation	deforest	+		+				+		+		+							-	-			+		
Performance	govern	+	+	+	+	+		+		+		+		+		+		+		+		+		+	
Income per capita	lngdppc		-	-	-			-			-	+			-		-	-		-		-	+	-	
Infant mortality	lninfant									+		+		+					+						
Population	lnpop	+		+		+		+	+	+	+			+		+									
FDI inflow	fdiinflow											+		+		+									
Democracy	democracy	+		+	+										-		-					-		-	
Colonial status	xcolony								+	+		+		+		+	+								
Volume of trade	lndyadtrade									-											+				
CDM partner	dyadcdm	+		+										+		+			+		+		-		
Regionalism	lndistance	-	-		-	-		-				-		-		-			-			+		+	

** Shaded areas not evaluated due to limited number of samples*

4.7. Conclusions

Several bilateral and multilateral donors have responded promptly to the challenge of mitigating climate change through their strategic allocation of mitigation finance across developing countries. These donors use different sets of criteria, reflecting their standpoints on how climate change should be addressed. Loans have been targeted at developing countries with a large quantity of emissions, and grants have been targeted at developing countries with a sizable area of bio-carbon sinks or forests. Donors use financial instruments as tools to mitigate emissions in the multi-sector of climate change, i.e. energy and forestry sectors. Along with their efforts to mitigate emissions by providing mitigation finance, they also respond to their recipients' performance and needs. Some bilateral donors allocate mitigation finance to recipients with good governance and lower per capita income; only a few donors, such as France, tend to give mitigation finance to developing countries with a high infant mortality rate. Donors' economic and political interests, such as Japan's tendency to choose trading partners and neighbouring countries as recipients, still influence their mitigation finance allocation decisions. Even Norway, which is known for its generosity, is inclined to give its mitigation finance to its CDM partners, indicating its interest in trading with developing countries in the carbon market.

As an extension of this study of the global allocation of mitigation finance, this chapter is limited to explaining whether current donors' allocation practices effectively address global climate change. There is an urgent need to assess the effectiveness of mitigation finance at the national level, such as through a study that investigates how the projects' objectives contribute to the wider objective of mitigating emissions. Another important study could evaluate the outcomes of climate change projects compared to their stated objectives. It is also important to clarify the extent to which each related sector, e.g. the energy and forestry sectors, can contribute to global emission mitigation. Last, it is important to analyse the achievement of public mitigation finance in scaling up and improving the institutional capacity of developing countries to become involved in the CDM market, where they can both contribute to and benefit from the reduction of global emissions.

APPENDIX 4.1: CHANNELS OF BILATERAL AND MULTILATERAL MITIGATION FINANCE

No.	Fund/ Programme/ Initiative	Full name	Arrangement (Multilateral, Bilateral)	Type	Funding source	Purpose (Mitigation Adaptation, Mixed)	Operated by	Accountable to	Trustee	Implementing entity	Year of Establishment
1	GEF	Global Environmental Facility	Multilateral	Fund	Mixed, mainly Public	Mixed	GEF Secretariat	GEF Assembly, GEF Council, GEF-NGO network, civil society (if invited by GEF CEO)	CFPMI World Bank	UNDP, UNEP, WB (initially), ADB, AfDB, ERDB, FAO, IADB, IFAD, UNIDO	1991
2	CIF-CTF	Climate Investment Funds - Clean Technology Fund	Multilateral	Fund	Public	Mainly Mitigation	CTF Committee members and administrative unit	Stakeholders: donors, civil society, indigenous people, African Development Bank, African Development Fund, ADB, European Bank, IDB, and World Bank Group	Trustee and Legal Team of IBRD World Bank	Developing countries	Jul 2008
3	CIF-SCF	Strategic Climate Fund	Multilateral	Fund	Public	Mitigation	SCF Committee members and administrative unit				Sep 2008
4	CIF-SCF-FIFP	Forest Investment Fund Program	Multilateral	Fund	Public	Mitigation	FIFP Sub-committee members and administrative unit				May 2009
5	CIF-SCF-PPCR	Pilot Program for Climate Resilience	Multilateral	Fund/ Program	Public	Mitigation	PPCR Sub-committee members and administrative unit				Nov 2008

6	CIF-SCF-SREP	The Program for Scaling-Up Renewable Energy in Low Income Countries	Multilateral	Fund/ Program	Public	Mitigation	SREP Sub-committee Members and administrative unit				May 2009
7	AF	Adaptation Fund	Multilateral	Fund	Mixed	Adaptation	Adaptation Fund Board	The World Bank, CDM Board	World Bank (interim trustee)	National/Multilateral Implementing Entities (NIEs /MIEs)	2007
9	JI	Joint Implementation	Multilateral and Bilateral	Initiative	Public	Mitigation	Supervisory Committee JI (SCJI)	CMP Kyoto Protocol and Accredited Independent Entity (AIE)	None	Annex I countries to result in Emission Reduction Unit (ERU)	1997 (Kyoto Protocol)
10	ETS	Emission Trading System	Multilateral and Bilateral	Initiative	Private	Mitigation	New South Wales (NSW) government (Australia), EU (EU-ETS), The New Zealand Emissions Trading Scheme (NZ ETS), Tokyo Metropolitan Government (TMG) (Japan).	CMP Kyoto Protocol	None	EU-ETS, Australian Securities Exchange, New Zealand, Japan, USA	1997 (Kyoto Protocol)
11	LDCF	Least Developed Country Fund	Multilateral	Fund	Mixed	Adaptation	GEF	UNFCCC – CMP, COP	CFPMI World Bank	GEF	Nov 2002 as a follow up of (Marrakech Accord 2001)
12	SCCF	Special Climate Change Fund	Multilateral	Fund	Mixed	Adaptation, technological transfer; capacity building	GEF	UNFCCC – CMP, COP	CFPMI World Bank	GEF	2001 (Marrakech Accord)

13	SPA	Strategic Priority Adaptation (Ended)	Multilateral	Fund	Public	Adaptation	GEF	UNFCCC – CMP, COP	CFPMI World Bank	Project partners and organisations	Proposed Nov 2003; Operationalised July 2004 – 2007
14	UN-REDD	United Nations collaborative programme on Reducing Emission from Deforestation and Forest Degradation	Multilateral	Program	Public	Mitigation	UNDP, UNEP	UNEP, UNDP, FAO, Multi-Partner Trust Fund, civil society, Indigenous People	None	UN-REDD Programme Partner Countries	Sept 2008- Dec 2015
15	MPMF	Montreal Protocol - Multilateral Fund	Multilateral	Fund	Public	Mitigation	MPMF secretariat	CMP Montreal Protocol	MPMF Executive committee	UNDP, UNEP, UNIDO, The World Bank	1991
16	CFF-PCF	Carbon Funds and Facilities - Prototype Carbon Fund	Multilateral	Fund	Mixed (Link)	Mitigation	Carbon Finance Unit, The World Bank	CMP Kyoto Protocol, Independent experts for baseline validation and verification for emission reductions.	CFPMI World Bank	Developing countries	Apr 2000
17	CFF-BCF	Bio Carbon Fund	Multilateral	Fund	Mixed	Mainly mitigation	Carbon Finance Unit, The World Bank	World Bank	IBRD, the World Bank	Developing countries	First trance: May 2004; Second trance: Mar 2007
18	CFF-CDCF	Community Development Carbon Fund	Multilateral	Fund	Mixed	Mainly mitigation	Carbon Finance Unit, The World Bank	World Bank	IBRD, the World Bank	Developing countries	Mar 2003
19	CFF-ICF	Italian Carbon Fund	Multilateral and Bilateral	Fund	Mixed	Mitigation	Carbon Finance Unit, The World Bank	World Bank	IBRD, the World Bank	Developing countries and countries with economies in transition	2003

20	CFF-NCDMF	The Netherlands CDM Facility	Multilateral and Bilateral	Fund	Public	Mitigation	Carbon Finance Unit, The World Bank	World Bank	IFC, the World Bank	Developing countries that generate potential credits under CDM	2002
21	CFF- NECF	The Netherlands European Carbon Facility	Multilateral	Fund	Public	Mitigation	Carbon Finance Unit, The World Bank	World Bank	IBRD, the World Bank	Countries with economies in transition	Aug 2004
22	CFF – DCF	Danish Carbon Fund	Multilateral and Bilateral	Fund	Mixed	Mitigation	Carbon Finance Unit, The World Bank	World Bank, the Danish Ministry of Climate and Energy, DONG Energy A/S, Aalborg Portland A.S., Maersk Olie og Gas A.S., and Nordjysk Elhandel A/S.	IBRD, the World Bank	Developing countries	Jan 2005
23	CFF – SCF	Spanish Carbon Fund	Multilateral and Bilateral	Fund	Public	Mitigation	Carbon Finance Unit, The World Bank	World Bank & the Ministries of Environment and Economy of Spain	IBRD, the World Bank	Developing countries and countries with economies in transition	2004
24	CFF – UCFT1	Umbrella Carbon Facility Trance 1	Multilateral	Fund	Mixed	Mitigation	Carbon Finance Unit, The World Bank	World Bank	IBRD, the World Bank	Developing countries	2006
25	CFF – CFE	Carbon Fund for Europe	Multilateral	Fund	Public	Mitigation	Carbon Finance Unit, The World Bank	European Investment Bank, World Bank	IBRD, the World Bank	Developing countries	?
26	CFF – UCFT2	Umbrella Carbon Facility Trance 2	Multilateral	Fund	Public	Mitigation	Carbon Finance Unit, The World Bank	World Bank	IBRD, the World Bank	Developing countries	Mar 2008

27	CFF –FCPF Known as REDD+	Forest Carbon Partnership Facility Reducing Emission from Deforestation and Forest Degradation	Multilateral	Fund/ program	Public	Mitigation	Carbon Finance Unit, The World Bank	The Participants Assembly to select the Participants Committee is made up of an equal number of forest (REDD+) countries (14) and financial contributors (14), and is also comprised of observers representing indigenous peoples, civil society, international organizations, the UN-REDD, the UNFCCC Secretariat and the private sector.	IBRD, the World Bank	37 forest developing countries (14 in Africa, 15 in Latin America and the Caribbean, and eight in Asia-Pacific)	Jun 2008 (FCPF) 2009 (REDD+)
28	CFF - CPF	Carbon Partnership Facility	Multilateral	Fund	Public	Mitigation	Carbon Finance Unit, The World Bank	World Bank	IBRD, the World Bank	Developing countries	2012
29	CFF – PMR	Partnership for Market Readiness	Multilateral	Fund	Public	Mitigation	Partnership Committee	Partnership Assembly	IBRD, the World Bank	Developing countries	2012
30	CFF – Ci-Dev	Carbon Initiative for Development	Multilateral	Fund	Public	Mitigation	Carbon Finance Unit, The World Bank	World Bank	IBRD, the World Bank	Developing countries	2012
31	MDGCF	MDGs – Carbon Facility	Multilateral	Fund	Public	Mitigation	UNDP	UN Assembly	UNDP	Developing countries	2008 (?)
32	GCF	Green Climate Fund	Multilateral	Fund	Mixed, mainly public	Mixed	GCF Secretariat	UNFCCC – CMP, COP, GCF Board	The World Bank - Financial Intermediary Fund (FIF) trust fund (Interim)	Developing countries	2009

33	MDTF	Multi-Donor Trust Fund	Multilateral	Fund	Public	Adaptation	World Bank	Bangladesh, WB, UK	World Bank	Bangladesh government	2009
34	ICCTF	Indonesia Climate Change Trust Fund	Multilateral	Fund	Public	Mixed	ICCTF secretariat, Technical Committee	Ministry of Development Planning Republic of Indonesia (Bappenas)	UNDP (interim)	Government Ministries, NGOs	2009
35	BAF	Brazil Amazon Fund	Multilateral	Fund	Mixed	Mitigation	Technical Committee, Steering Committee	Ministry of Environment (Emission Calculation), National Institute for Space Research (INPE/MCT) for deforestation rate, Donators (Government, NGOs, companies, indigenous people)	BNDES – Brazilian Developm ent Bank	Governments, NGOs	2008
36	CEP	Cool Earth Partnership	Bilateral	Initiative	Mixed	Mainly Mitigation, adaptation	Ministry of Foreign Affairs (MOFA) of Japan	JBIC (JBIC Asia and Environment Facility), trade and investment insurance by NEXI, and government support (projects to be implemented through NEDO), together with private funds	None	JICA	Nov 2008 (agreed), operationalized in 2009
37	ICF	International Climate Fund - Formerly Environmental Transformatio n Fund (ETF-IW)	Bilateral	Fund	Public	Mixed	Department of Energy and Climate Change (DECC), Department for International Development (DFID), Department for Environment, Food, and Rural Affairs (Defra)	Independent commission on Aid impact (ICAI)	None	DECC, DFID, Defra	ICF – 2011

38	NICFI	Climate and Forest Initiative	Bilateral	Fund/ Initiative	Public	Mainly Mitigation, adaptation	The Norwegian Agency for Development Cooperation (Norad)	Norwegian Ministry of Foreign Affairs (MFA)	None	Multi-channelling	2008
39	GCCA	The Global Climate Change Alliance	Multilateral	Fund/ Initiative	Public	Mitigation	European Commission (EC)	EC member countries		Multi-channelling to The Least Developed Countries (LDCs) and the Small Island Developing States (SIDS)	2007
40	IFCI	International Forest Carbon Initiative	Bilateral	Fund/ Initiative	Public	Mitigation	Department of Climate Change and Energy Efficiency	Australian Government	-	Multi-channelling mainly to REDD+	Initiated at Bali Action Plan 2007
41	ICI	International Climate Initiative	Bilateral	Fund/ Initiative	Public	Mitigation	The Federal Ministry for the Environment, Natural Conservation, and Nuclear Safety	German Government	-	Developing countries potentially through GIZ	2008
42	GFDRR	Global Facility for Disaster Reduction and Recovery	Multilateral	Fund	Public	Adaptation	Management council, GFDRR Secretariat	Consultative group (The World Bank, donor reps, observers) more…	-	Multi-channelling	Feb 2007
43	GFC	Global Fund Climate	Multilateral	Fund	-	-	-	US	-	-	(not established due to lack of supports)

APPENDIX 4.2: LIST OF VARIABLES AND DATA SOURCES

Label	Explanation	Data Source
Dependent variable		
lngrantcom	Log of overall commitment mitigation finance grant in US$ constant 2010	OECD (2012a)
lnloancom	Log of overall commitment mitigation finance loan in US$ constant 2010	(*ibid*)
lnjpncom	Log of Japan's commitment mitigation finance in US$ constant 2010	(*ibid*)
lndeucom	Log of Germany's commitment mitigation finance in US$ constant 2010	(*ibid*)
lnfracom	Log of France's commitment mitigation finance in US$ constant 2010	(*ibid*)
lnespcom	Log of Spain's commitment mitigation finance in US$ constant 2010	(*ibid*)
lnnorcom	Log of Norway's commitment mitigation finance in US$ constant 2010	(*ibid*)
lndencom	Log of Denmark's commitment mitigation finance in US$ constant 2010	(*ibid*)
lneucom	Log of EU institution's commitment mitigation finance in US$ constant 2010	(*ibid*)
lngefcom	Log of GEF institution's commitment mitigation finance in US$ constant 2011	OECD (2012b)
lnbilcom	Log of all bilateral commitment mitigation finance in US$ constant 2010	OECD (2012a)
lngrantdis	Log of overall disbursement mitigation finance grant in US$ constant 2010	(*ibid*)
lnloandis	Log of overall disbursement mitigation finance loan in US$ constant 2010	(*ibid*)
lnjpndis	Log of Japan's disbursement mitigation finance in US$ constant 2010	(*ibid*)
lndeudis	Log of Germany's disbursement mitigation finance in US$ constant 2010	(*ibid*)
lnfradis	Log of France's disbursement mitigation finance in US$ constant 2010	(*ibid*)
lnespdis	Log of Spain's disbursement mitigation finance in US$ constant 2010	(*ibid*)
lnnordis	Log of Norway's disbursement mitigation finance in US$ constant 2010	(*ibid*)
lndendis	Log of Denmark's disbursement mitigation finance in US$ constant 2010	(*ibid*)
lneudis	Log of EU institution's disbursement mitigation finance in US$ constant 2010	(*ibid*)
lngefdis	Log of GEF institution's disbursement mitigation finance in US$ constant 2011	OECD (2012b)
lnbildis	Log of all bilateral disbursement mitigation finance in US$ constant 2010	OECD (2012a)

Independent variable		
lnco2	Log of CO_2 emissions kt	WDI (2013)
rci	CO_2 emissions intensity at time-t/ CO_2 emissions intensity at time-(t-1)	Author's calculation (GDP and CO_2 data are from WDI (2013))
lnforest	Log of available forest land in 1000HA	FAO (2012)
deforest	Percentage of forest loss (1998-2000, 2000-2005, 2005-2010)	(*ibid*)
govern	Average of governance indicators	Kaufmann *et al.* (2010)
dyadtrade	Log of sum export and import in US$ constant 2010	OECD (2012)
population	CDM dummy (CDM investment coded 1; 0 otherwise)	UNFCCC (2013)
dyadxcolony	Pair ex-colony between each donor-recipient coded 1; 0 otherwise. EU case include all ex-colonies of EU members and for multilateral donors, ex-colonies of DAC members	Hensel (2009); Mayer and Zignago (2011)
acp	African Caribbean Pacific Countries are coded 1; 0 otherwise	EU contonou
distance	Log of distance in km between capital city's donor-recipients	Mayer and Zignago (2011)
lngdppc	Log of income per capita	WDI (2013)
	Log of population	
fdiinflow	Foreign direct investment inflow	WDI (2013)
democracy	Levels of democracy	Marshall et al. (2011)
	Coded 1 for that year, 0 otherwise	
lnbilcliaid	In the case of EU and GEF	OECD (2012a)

APPENDIX 4.3: ADDITIONAL ROBUSTNESS CHECKS

Table 0.11: CO_2 intensity of developing countries and mitigation finance inflows

	Grant				Loan			
	Commitment		Disbursement		Commitment		Disbursement	
	Selection	Allocation	Selection	Allocation	Selection	Allocation	Selection	Allocation
	(45)	(46)	(47)	(48)	(49)	(50)	(51)	(52)
lnco2	0.101	-0.114	-0.253**	-0.016	0.358*	0.496	0.499**	0.539
	(0.753)	(-0.729)	(-1.973)	(-0.124)	(1.910)	(1.234)	(2.401)	(1.413)
rci	-0.121	0.455	-0.368	0.584	2.478***	-1.552	0.401	-0.205
	(-0.138)	(0.390)	(-0.418)	(0.718)	(2.698)	(-0.593)	(0.348)	(-0.100)
lnforest	0.184***	0.132**	0.208***	0.120***	0.025	-0.002	-0.054	0.126
	(3.605)	(2.060)	(3.925)	(2.590)	(0.361)	(-0.024)	(-0.902)	(0.812)
deforest	0.011	0.189**	0.130	0.123*	0.697***	-0.340**	0.652***	-0.099
	(0.149)	(2.048)	(1.548)	(1.713)	(4.403)	(-2.268)	(5.475)	(-0.373)
lngdppc	0.951***	0.879***	0.887***	0.685***	0.632*	0.254	1.040***	1.343
	(3.376)	(3.065)	(3.078)	(2.832)	(1.848)	(0.383)	(3.046)	(1.247)
lninfant	-0.470***	-0.474**	-0.176	-0.544***	-0.531**	-1.061**	-1.074***	-0.986**
	(-2.713)	(-2.457)	(-1.020)	(-3.459)	(-2.355)	(-2.161)	(-4.089)	(-2.065)
lnpop	0.503**	-0.088	0.685***	-0.322*	0.157	-0.756*	0.161	-1.301***
	(2.436)	(-0.375)	(3.407)	(-1.732)	(0.491)	(-1.753)	(0.481)	(-3.138)
govern	0.305*	0.583***	0.729***	0.420**	0.505**	-0.146	0.238	0.143
	(1.761)	(2.922)	(4.475)	(2.569)	(2.089)	(-0.295)	(0.898)	(0.333)
fdiinflow	0.016	0.054**	0.033	0.020	0.083***	-0.087	0.025	-0.020
	(0.799)	(2.455)	(1.534)	(0.831)	(3.761)	(-1.360)	(0.740)	(-0.405)
democracy	0.069***	0.011	0.059***	0.012	0.054*	-0.025	0.064***	0.008
	(3.815)	(0.498)	(3.197)	(0.768)	(1.827)	(-0.896)	(2.597)	(0.194)
xcolony	-0.422**	-0.107	-0.351*	0.051	0.130	0.077	-0.005	0.779
	(-2.072)	(-0.473)	(-1.716)	(0.278)	(0.405)	(0.234)	(-0.016)	(1.468)
χ^2	191.7		198.7		109.5		141.3	
R^2		0.256		0.312		0.603		0.518
Adjusted R^2		0.226		0.284		0.476		0.415
P-values	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	762	488	762	480	762	79	762	109

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

Table 0.12: MPAs of developing countries and mitigation finance inflows

	Grant				Loan			
	Commitment		Disbursement		Commitment		Disbursement	
	Selection	Allocation	Selection	Allocation	Selection	Allocation	Selection	Allocation
	(53)	(54)	(55)	(56)	(57)	(58)	(59)	(60)
lnco2	-0.129	-0.286*	-0.418***	-0.303*	0.281	0.185	-0.147	0.298
	(-0.979)	(-1.659)	(-3.134)	(-1.730)	(1.449)	(0.350)	(-0.683)	(0.608)
lnforest	0.157***	0.086	0.203***	0.037	-0.039	-0.073	-0.157**	-0.001
	(3.315)	(1.306)	(4.175)	(0.687)	(-0.526)	(-0.961)	(-2.361)	(-0.006)
deforest	0.011	0.170*	0.123*	0.132**	0.740***	-0.380*	0.899***	0.152
	(0.178)	(1.912)	(1.748)	(1.997)	(4.931)	(-1.822)	(6.393)	(0.553)
marine	0.020***	0.017**	0.019**	0.014**	0.007	-0.034	0.001	-0.183**
	(2.617)	(2.343)	(2.408)	(2.012)	(0.341)	(-1.370)	(0.040)	(-2.609)
lngdppc	0.849***	0.864***	0.788***	0.382	0.627*	0.647	0.504	-1.294
	(3.097)	(3.024)	(2.802)	(1.595)	(1.680)	(0.939)	(1.382)	(-1.092)
lninfant	-0.315**	-0.158	-0.126	-0.083	-0.515**	-0.895	-0.740***	0.124
	(-1.965)	(-0.833)	(-0.771)	(-0.413)	(-2.263)	(-1.605)	(-2.983)	(0.213)
lnpop	0.193	-0.309	0.202	-0.515**	0.016	-1.020*	-0.558	-0.147
	(0.879)	(-1.282)	(0.901)	(-2.572)	(0.050)	(-1.818)	(-1.412)	(-0.363)
govern	0.605***	0.827***	0.874***	0.952***	0.639**	0.373	1.260***	0.388
	(3.491)	(3.600)	(5.013)	(4.013)	(2.361)	(0.555)	(4.291)	(0.603)
fdiinflow	0.003	0.048**	-0.007	0.084***	0.040**	-0.091	0.027	-0.027
	(0.101)	(2.379)	(-0.370)	(3.275)	(2.108)	(-1.235)	(0.916)	(-0.389)
democracy	0.041**	-0.005	0.035*	0.029*	0.056*	-0.021	0.077**	0.031
	(2.174)	(-0.227)	(1.803)	(1.806)	(1.828)	(-0.591)	(2.557)	(0.688)
xcolony	-0.376*	0.182	-0.046	0.277	0.225	0.118	0.310	1.199**
	(-1.680)	(0.741)	(-0.205)	(1.436)	(0.654)	(0.309)	(0.845)	(2.407)
χ^2	198.3		217.2		122.2		775.1	
R^2		0.245		0.344		0.648		0.567
Adjusted R^2		0.212		0.314		0.510		0.453
P-values	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	804	472	804	453	804	72	804	92

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

Table 0.13: France's mitigation finance and developing countries' infant mortality and income per capita

Disbursement selection stage	(29)+	(61)	(62)
lnco2	0.071	-0.198	0.383**
	(0.286)	(-0.865)	(2.081)
lnforest	0.502***	0.530***	0.617***
	(4.085)	(4.237)	(4.265)
deforest	0.615***	0.423**	0.596***
	(3.028)	(2.107)	(2.910)
govern	1.320**	0.951**	1.591***
	(2.388)	(2.028)	(3.010)
lngdppc	0.591**	0.450*	
	(2.197)	(1.716)	
lninfant	1.212***		1.114***
	(3.165)		(2.960)
lnpop	0.480	0.746**	0.007
	(1.492)	(2.420)	(0.028)
fdiinflow	0.048**	0.042*	0.040**
	(2.358)	(1.898)	(1.976)
democracy	-0.063*	-0.071**	-0.069*
	(-1.672)	(-2.044)	(-1.913)
lnfratrade	0.364	0.359	0.605
	(0.924)	(0.914)	(1.484)
cdmesp	-0.125	-0.068	-0.032
	(-0.198)	(-0.114)	(-0.049)
dyadxcolony	1.571***	1.839***	1.565***
	(3.610)	(4.209)	(3.807)
lnfradistcap	-1.456***	-1.346***	-1.569***
	(-5.241)	(-5.768)	(-5.650)
χ^2	1076.3	1431.5	1064.5
P-values	0.000	0.000	0.000
N	954	954	954

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively. +As in Table 4.7

Table 0.14: Mitigation finance grant and loan using Heckman's Selection Model

	grant				loan			
	commitment		Disbursement		Commitment		Disbursement	
	Selection	Allocation	Selection	Allocation	Selection	Allocation	Selection	Allocation
	(c64)	(c64a)	(c65)	(c65a)	(c66)	(c66a)	(c67)	(c67a)
lnco2	0.155*	-0.051	0.103	0.071	0.219**	0.770**	0.383**	0.683**
	(1.866)	(-0.343)	(1.090)	(0.371)	(2.388)	(2.300)	(1.993)	(2.018)
lnforest	0.079*	0.203***	0.117**	0.177***	-0.020	-0.022	-0.047	0.107
	(1.862)	(3.345)	(2.555)	(2.591)	(-0.503)	(-0.366)	(-0.648)	(0.819)
deforest	0.001	0.103	0.045	0.085	0.258***	-0.068	0.302***	-0.005
	(0.031)	(1.159)	(0.868)	(1.062)	(3.002)	(-0.446)	(3.029)	(-0.016)
govern	-0.289***	-0.420***	0.706***	-0.534**	-0.313***	-0.989**	0.523*	-1.210**
	(-2.703)	(-2.721)	(3.667)	(-2.347)	(-2.898)	(-2.210)	(1.694)	(-2.467)
lngdppc	0.261	-0.147	-0.249**	-0.328	0.011	-0.642	-0.596**	-1.356***
	(1.542)	(-0.681)	(-2.220)	(-1.330)	(0.075)	(-1.533)	(-2.172)	(-3.169)
lninfant	0.090	0.510***	0.337**	0.380	0.232**	-0.236	0.070	0.161
	(0.791)	(2.664)	(2.069)	(1.562)	(2.281)	(-0.532)	(0.226)	(0.393)
lnpop	0.623***	1.135***	0.107	0.956***	0.337	-0.166	0.056	1.427
	(3.508)	(4.395)	(0.879)	(3.103)	(1.479)	(-0.285)	(0.223)	(1.443)
fdiinflow	0.004	0.037**	0.002	0.022	0.024***	-0.086	0.004	-0.016
	(0.301)	(2.142)	(0.134)	(0.890)	(2.646)	(-1.537)	(0.225)	(-0.335)
democracy	0.025**	-0.006	0.017	0.002	0.030*	0.009	0.037**	0.022
	(2.036)	(-0.285)	(1.331)	(0.099)	(1.889)	(0.379)	(1.969)	(0.429)
xcolony	-0.232	-0.249	-0.173	-0.166	0.061	0.183	-0.164	0.761
	(-1.429)	(-1.050)	(-1.008)	(-0.557)	(0.338)	(0.556)	(-0.573)	(1.197)
reddplus	0.489***		0.611***		-0.117		0.116	
	(2.830)		(3.143)		(-0.600)		(0.436)	
Rho (ϱ)		0.253		0.288		0.539		0.319
χ^2		243.0		187.4		352.1		287.7
P-values		0.000		0.000		0.000		0.000
N		1064		1064		1064		1064

Note: Heteroscedasticity-corrected t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively. +As in Table 4.7

APPENDIX 4.4: THE COTONOU AGREEMENT ARTICLE 32A

Climate change

The Parties acknowledge that climate change is a serious global environmental challenge and a threat to the achievement of the Millennium Development Goals requiring adequate, predictable and timely financial support. For these reasons, and in accordance with the provisions of Article 32, and particularly of point (a) of paragraph 2 thereof, cooperation shall:

1) *recognise the vulnerability of ACP States and in particular of small islands and low-lying ACP States to climate-related phenomena such as coastal erosion, cyclones, flooding and environmentally induced displacements, and in particular of least developed and landlocked ACP States to increasing floods, drought, deforestation and desertification;*

2) *strengthen and support policies and programmes to mitigate and adapt to the consequences of, and threat posed by, climate change including through institutional development and capacity building;*

3) *enhance the capacity of ACP States in the development of, and the participation in, the global carbon market; and*

4) *focus on the following activities:*

- **a)** *integrating climate change into development strategies and poverty reduction efforts;*
- **b)** *raising the political profile of climate change in development cooperation, including through appropriate policy dialogue;*
- **c)** *assisting ACP states to adapt to climate change in relevant sectors such as agriculture, water management and infrastructure, including through transfer and adoption of relevant and environmentally sound technologies;*
- **d)** *promoting disaster risk reduction, reflecting that an increasing proportion of disasters are related to climate change;*
- **e)** *providing financial and technical support for mitigation action of ACP states in line with their poverty reduction and sustainable development objectives, including reducing emissions from deforestation and forest degradation and reducing emissions in the agricultural sector;*
- **f)** *improving weather and climate information and forecasting and early warning systems; and*
- **g)** *promoting renewable energy sources, and low-carbon technologies that enhance sustainable development.*

APPENDIX 4.5: LIST OF ADDITIONAL ABBREVIATIONS

AFD	Agence Française de Développement
BMZ	Federal Ministry for Economic Cooperation and Development
DANIDA	Ministry of Foreign Affairs of Denmark
DECC	Department of Energy and Climate Change
DFID	Department for International Development
ECON	Ministry of Economy and Finance
FCO	Foreign and Commonwealth Offices
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IDA	International Development Association
JICA	Japan International Cooperation Agency
MAE/FSP	Mutuelle des Affaires Etrangères/French Fund for Priority Solidarity
MFA	Ministry of Foreign Affairs
MIE	Ministerio de Industria Energía Y Turismo
MINEFI	Ministère de l'Economie et des Finances
NORAD	The Norwegian Agency for Development Cooperation – a directorate under the Norwegian MFA
NORFUND	Norwegian Investment Fund for Developing Countries
OPEC	*Organisation of Petroleum Exporting Countries*
USAID	United States Aid
WB	World Bank

5. CLIMATE MITIGATION FINANCE: INCENTIVES, INSTITUTIONS AND COLLECTIVE ACTION

Abstract

This chapter analyses two main issues surrounding the use of official mitigation finance taken from ODA. The frameworks of the analyses are largely adopted from an institutional analysis and development framework. The first part discusses what qualities or aspects of mitigation finance act as incentives for mitigating GHG emissions in developing countries. It particularly considers whether mitigation finance offers a perverse incentive. The second analyses the foreseeable arrangement of mitigation finance as a new international financial category, particularly exploring whether mitigation finance is only temporarily reliant on ODA as its source of funding or will become a permanent part of ODA. This chapter also offers insights into the policy implications of mitigation finance allocation across developing countries and the development of mitigation finance as an institution. Greater understanding of the policy implications of mitigation finance allocation is expected to improve its effectiveness and support its formation as an emerging category of international development finance.

Key words: Mitigation finance, climate mitigation, incentive, institutional theory, collective action

5.1. Introduction

The two previous chapters have shown that official mitigation finance, taken from ODA, is determined by a number of factors representing the objectives of mitigation finance, ODA and the political and economic interests of donors i.e. those supporting ex-colonies and CDM and regional partners. To a limited extent mitigation finance shares the ODA's aims of promoting local development and halving poverty, but it mainly carries a global mission to reduce GHG emissions, which benefits countries and people globally. The global mission of mitigation finance and its unsettled institutional arrangement, which relies on ODA – whose intended objectives are local and national development – add tremendous complexity to its nature as foreign aid intended to result in slowing the growth of global emissions and alleviating local poverty.

Effective mitigation finance is influenced by the extent to which the strategies behind its allocation enhance cooperation between developed and developing countries to collectively mitigate emissions and pursue low-carbon pathways. Uniquely, unlike poverty aid, whose effectiveness depends on the recipient country's policy performance (Collier & Dollar, 2002), global mitigation finance is rather ineffective if the world collectively depends on the cooperation of a few countries and donors and the resulting reduction in emissions. Addressing global warming is a huge challenge requiring international cooperation (Baylis *et al.*, 2009, p. 364; Sandler, 2004, p. 212).

For the mitigation of emissions to be effective, all countries will need to agree on and act together to limit global warming to around 2°C above pre-industrial levels (Stewart *et al.*, 2009, pp. 35–41). If some countries and mitigation finance recipients reduce their emission levels while others continue polluting irresponsibly, mitigation finance will only temporarily and partially mitigate the emissions of a few keen countries but overall, global emissions will surpass the targeted levels. Collective action is a condition of mitigation finance achieving its intended outcome of mitigating global emissions, and it can easily fail due to a free rider problem where some countries without any effort earn benefits from some other countries' action (Parks & Roberts, 2010, p. 147). Therefore, the effectiveness of global climate mitigation depends on mitigation finance's ability to avoid this problem and to promote global mitigation action.

Mitigation finance can be an attractive incentive to developing countries to pursue low-carbon pathways. It offers considerable potential financial inflows and future investment opportunities in sectors such as renewable energy and transportation. Although in 2009 the amount of mitigation finance was still relatively small at approximately 0.8% of total ODA, as discussed in Chapter 2, the 2009 Copenhagen Accord has set a long-term global annual target for climate finance of US$100 billion by 2020 (Buchner, Brown & Corfee-Morlot, 2011, p. 56). This amount includes mitigation and adaptation finance from various potential sources, including the private sector. Following this formal written commitment there have been deliberate attempts to mobilise and track global private and public financial resources to achieve this target (Clapp *et al.*, 2012; VanKerkhoff *et al.*, 2011). For developing countries that are potential recipients of mitigation finance, this global financial target of US$100 billion increases the attractiveness of participating in mitigating global emissions. The financial inflow for a developing country that receives both mitigation and adaptation finance and is prepared to join the global carbon market is potentially very large (Bosetti *et al.*, 2009). This opportunity may trigger developing countries' positive involvement in the action to mitigate climate change and pursue low-carbon pathways.

Naturally, in the absence of mitigation finance there is little incentive for developing countries to voluntarily commit to mitigating climate change and pursue low-carbon pathways. Although Mathiesen *et al.* (2011) show that countries may harvest socioeconomic benefits if they run wholly on renewable energy, in current conditions improving energy efficiency is considered costly and there is uncertainty about the extent of the benefits, the costs and the negative effects on economic output (Berkeley *et al.*, 1998; Keller *et al.*, 2004; Pielke Jr., 2009). While developing countries' development and economic growth mainly rely on fossil-fuel technologies they have to continue polluting to reach their economic goals, and hence there is a conceivable trade-off between mitigating emissions and development via fossil-fuelled economic growth (Stern, 2008b). When fossil fuel is still the major source of energy, without incentives for emission mitigation, developing countries may be reluctant to agree to reduce their emissions since this would slow down their economic performance.

The non-cooperation of large polluting countries nullifies other countries' mitigation efforts. Some developed countries (Annex I parties to the UNFCCC) have committed to emission targets as an expression of bearing responsibility for their historical emissions. Some of these countries have committed to a binding agreement to reduce their emission levels. They also provide mitigation finance for developing countries to prepare them to join the global carbon market and to reduce their emissions. However, as previously discussed, global emission mitigation that relies only on industrialised countries is inadequate. Without the participation of all countries, including the developing countries, the efforts of Annex I countries are ineffective (den Elzen & Höhne, 2008). Even if most developing countries participate but large developing countries such as China, India and Indonesia do not, mitigation finance will not achieve its intended outcomes (Chandler *et al.*, 2002).

The non-participation of large emitters threatens the national security of all countries with effects such as potential damage from extreme weather and other disastrous natural events caused by the negative impacts of climate change. These threats tend to incentivise countries that are engaged in reducing their emissions and helping others to do so to encourage other countries to follow their lead and collectively commit to a legally-binding target. To foster cooperation in global mitigation action, donors and countries that have made considerable mitigation efforts are inclined to prioritise the climate change agenda and to allocate ODA as mitigation finance. This policy contains the danger that mitigation finance may potentially crowd out ODA, which is intended to eliminate poverty and to benefit recipient countries exclusively.

While providing aid can be seen as a moral obligation to alleviate poverty in distant countries (Chatterjee, 2004) with extended trade and political benefits, providing mitigation finance may be seen as a reaction to future threats arising from the negative impacts of climate change, and to result in global public goods that benefit not only the donors but everyone else on earth. One can argue that donor countries may also gain economic benefits by providing poverty aid such as through enhanced trading conditions (Javed, 2008), but normally the economic benefit of poverty aid is between the donors and the recipients, and to some extent the donor countries' companies when the donor has intentionally maximised the economic return from aid transactions such as by imposing a condition that the recipient makes specific procurements from such companies (Scholl, 2009). Mitigation finance and its global mission have more relevance for global development, since the former is expected to result in global GHG emission reduction. Mitigation finance may benefit self-interested donors, and can be seen as a precautionary step and a long-term strategy to secure their national security when it is allocated to preparing developing countries to join global emission trading mechanisms through which developed countries are able to mitigate their emissions via offsetting their carbon and mitigating emissions in developing countries where per unit of emission reduction is possibly cheaper than in developed countries.

The function of the UNFCCC as an intermediary platform for the facilitation of global collective action to mitigate emissions is limited. Many of the negotiations that it has hosted have ended in deadlock. Perhaps there is no conceivable incentive for participating in mitigation global emissions (Bodansky, 2010b). The Kyoto Protocol, the UNFCCC's product, clarifies the responsible parties, those that have to take or pay for such, but these legal conventions do not specify how much and under what conditions this should be carried out (Page, 2008). Even though the Convention and the Protocol regulate and limit the emissions of Annex I countries, UNFCCC does not have the legitimate power, such as that of the International Court of Justice or the World Trade Organisation, to impose sanctions on parties that do not comply with or violate the stated clauses in the international trade agreements.

Several unmet challenges hinder international negotiations towards a legally binding agreement. There is an imbalance of economic and political power between large and small and between rich and poor countries: some rich countries have more funding, which enables them to employ more delegations and well-trained negotiators. With greater knowledge and more negotiators, powerful countries can intimidate poor and small developing countries with few negotiators; rich countries and those with significant economic power can use their privileges to resist a certain arrangement (Gibson *et al*., 2005). For instance, a closed quorum and discussion between developed countries and large countries such as China happened during the 2009 Copenhagen meeting.

Overall, there is also an asymmetry between poor and rich countries in terms of knowledge and information related to climate science and the consequences of climate change, with rich countries much more able to fund climate research (Parks & Roberts, 2010, p. 147). Large polluting countries that have insufficient information about the cost of not participating, or have sufficient information but lack motivation, may avoid their responsibility due to a higher incentive to continue with high fossil-fuelled economic growth (Gibson *et al*., 2005). Additionally, as there is no systematic method of guaranteeing the delivery of donors' commitments there is a considerable gap between commitments and actual disbursement, as shown in Chapter 2. Under the current UNFCCC system most action is voluntary and there are no severe penalties for noncompliance.

Besides cooperation as the primary criterion for global mitigation finance to be effective, there is another official and fundamental rule that the allocation of climate finance has to be additional to the 0.7% of ODA of GNI designated for reducing global poverty (Buchner *et al*., 2011, p. 14). However, in 2009 only 5 out of the 23 DAC donors – Norway, Denmark, Finland, the Netherlands and Luxembourg – had surpassed this target (OECD, 2009b). Most donors give less than the 0.7% ODA target, and moreover a share of what they do give is designated as mitigation finance. If this continues, mitigation finance will negatively affect the amount of poverty reduction achieved through ODA. This lack of institutional integrity in mitigation finance raises two concerns: how much ODA mitigation finance will replace, and how long this undesirable arrangement will be continued.

To the author's knowledge, to date no peer-reviewed paper conceptually analyses global mitigation finance using an institutional analysis and development (IAD) framework used by aid scholars to analyse ODA more broadly. The present analysis centres on global mitigation finance as an instrument that can effectively contribute to solving the global mitigation problem and act as a new category of international development finance. This discussion frames the three earlier empirical chapters and identifies their relevance to the broader picture of the global effort to mitigate the world's GHG emissions.

The chapter addresses two main questions. The first asks what qualities or aspects of mitigation finance act as incentives for mitigating GHG emissions in developing countries. It particularly considers whether mitigation finance offers a perverse incentive. The second question asks about the foreseeable arrangement of mitigation finance as a new international financial category, particularly exploring whether mitigation finance is only temporarily reliant on ODA as its source of funding or will become a permanent part of ODA.

To answer these two questions, the chapter is organised into four sections: the first explains the IAD framework that underlies the study of mitigation finance allocation, and its assumptions. The second section addresses the first question by reflecting on positive and normative aspects of mitigation finance as an incentive for mitigating GHG emissions in developing countries; namely its functions, scale and attractiveness. The third section answers the second question by analysing the conditions that may lead to the adoption of mitigation finance as a permanent arrangement as part of ODA, and the consequences of this. The fourth section retrospectively analyses the development of mitigation finance so that both developed and developing countries collectively contribute financially to global emission reduction efforts. The last section offers concluding remarks.

5.2. The institutional analysis and development (IAD) framework

The IAD framework was introduced in 1973 (Ostrom, 1999; 2005) and is widely used to analyse various aspects of foreign aid (Gibson *et al.*, 2005).

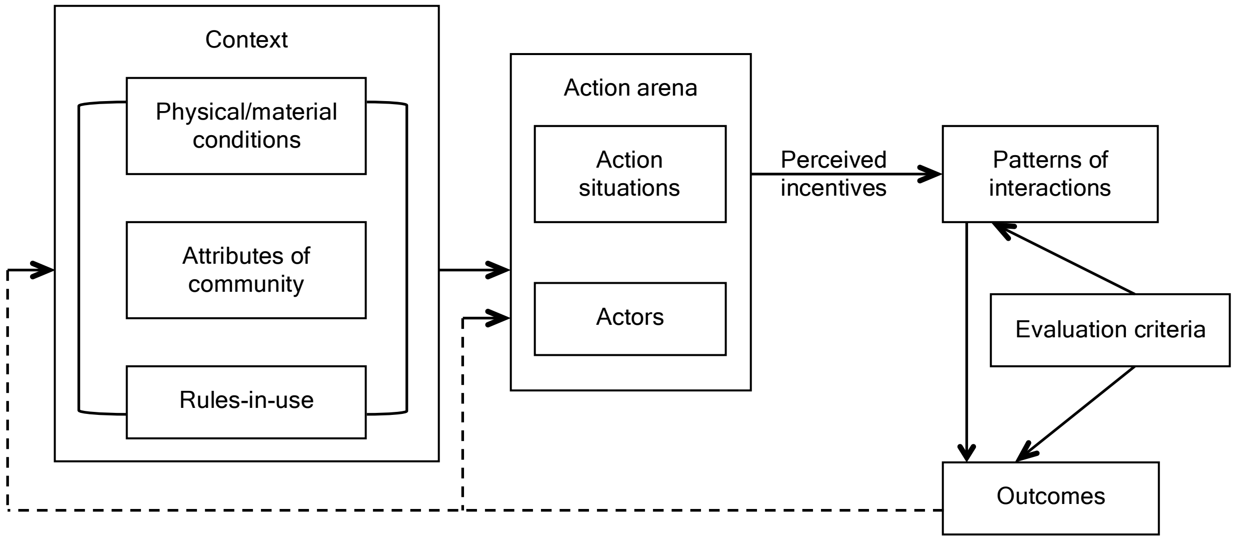
The IAD framework is useful for analysing the institutional aspects of mitigation finance surrounding and influencing decisions about its allocation to developing countries. In addition it can help reveal the implications of using mitigation finance as an incentive to solve a collective global problem.

There are two reasons why the IAD framework is suitable for the purposes of this chapter. First, the multidisciplinary approach of the IAD framework to analysing general foreign aid is transferable to examining mitigation finance, a multidisciplinary subject whose building blocks are climate and environmental science, economics, the political and social sciences and financial and business management.

Second, the design of the IAD framework allows observation of an arrangement, like an organisation or scheme that is part of a continual process. Like foreign aid, mitigation finance is administered by and within the context of multi-level organisations; i.e. operational activities at different project levels, policy-making and national and international levels (Gibson *et al.*, 2005, p. 24). Lastly, mitigation finance is the result of an interactive process between developed and developing countries.

The IAD framework, shown in Figure 5.1 below, brings together and establishes connections between all the elements studied and discussed in this thesis. Understanding each element of the framework is useful when scrutinising the arrangement of institutional elements – the context, action arena, incentives, evaluation criteria, interactions and outcomes – and the behaviour of the actors within and surrounding mitigation finance and influencing its allocation to developing countries.

Figure 5.1: A framework for institutional analysis



Source: Gibson *et al.* (2005, p. 26)

Context, the first element of the IAD framework, has three sub-components: physical/material conditions, attributes of community, and rules-in-use. The first, material conditions – in this case the establishment and development of mitigation finance – was introduced in Chapter 1. The second element, the attributes of the mitigation finance community, is explained throughout all the main chapters in this thesis. They are qualities that differentiate mitigation finance from other types of official aid, such as the definition and objectives of mitigation finance that differentiate it from adaptation finance and poverty aid.

The stated rules-in-use, as the third sub-component of the context of mitigation finance, are explained in the introductory chapter and throughout Chapters 2, 3 and 4, the main empirical chapters of this thesis. Chapter 2 reports the rules, such as the coding rules, used and agreed by OECD and DAC donors to report and code projects funded by mitigation and/or adaptation finance. It also explains the data consisting of the committed and disbursed amounts of mitigation finance. The empirical assessments conducted in Chapters 3 and 4 aim to clarify the inexplicit allocation rules and criteria used by donors overall and by individual bilateral donors to allocate their mitigation finance. The last part of Chapter 4 discusses in detail the allocation rules and criteria that the GEF and EU use to allocate their mitigation finance.

According to the IAD framework, the contextual elements influence the action arena in which actors with different roles interact and influence each other. In this thesis the action arena for mitigation finance is set at the global level, and each country, whether a donor or a recipient, is seen as a unitary actor. Chapter 2 introduced the actors that provide mitigation finance and tests several variables that represent their characteristics to understand how these determine the amount of mitigation finance supplied and the frequency at which the countries concerned report their allocation of it. Chapter 3 discussed who receives mitigation finance and which of the characteristics of these recipient actors determines whether they will receive it from DAC donors – and if they do receive it, which characteristics determine the amount that they receive. Chapter 4 analysed how each donor's allocation of mitigation finance is influenced by the recipients' characteristics. All three chapters aim to enhance understanding of mitigation finance actors and the characteristics or situations that influence their action and behaviour.

Under the assumption of rational behaviour, each actor, whether donor or recipient, makes a decision based on its rational preference to pursue the normative goals of mitigation finance as well as to maximise its gains guided by its own self-interests (Gowdy, 2008). The author's assumption that a country is a rational actor is not due to lack of awareness of the existence of the complex network within which many mitigation finance sub-actors influence national and international policymaking.

The economic model of rational behaviour is an appropriate tool for institutional analysis, such as that of the allocation of mitigation finance, if the object of the analysis meets two conditions. First, the model is a relevant tool for institutional analysis when perceived incentives for a particular situation are not clearly captured, thoroughly investigated and explained (see Figure 5.1). The allocation of mitigation finance fulfils this first condition, as the incentives for providing or receiving mitigation finance are not yet clear. Knowing the clear perceived incentives of actors will elucidate the patterns of interaction among donors and recipients that affect the effect of mitigation finance on the reduction of global GHG emissions. Considering that mitigation finance has only recently been provided by donor countries, it may be too early for comprehensive and rigorous evaluations of the outcomes of the interventions that it has funded. Many projects funded by mitigation finance are still in their early stages, and at this point seeking evidence that mitigation finance has reduced emission levels in developing countries may be premature.

The evaluation criteria for mitigation finance set by donors and evaluators will also influence global GHG emission reduction as the outcome of mitigation finance. The criteria for most bilateral donors' allocation are not transparent or available to the general public and hence remain unclear. To improve understanding of the criteria used to allocate mitigation finance to developing countries, this thesis identifies whether the determinants, which would presumably be used if mitigation finance is to be allocated most effectively to developing countries, are actually used in its allocation. For instance, mitigation finance would be most effective if it is allocated to where the largest scale of GHG emission reduction can take place, such as via the energy and forestry sectors.

Second, the economic model of rational behaviour is relevant for the analysis of an institution when the object of analysis comprises symmetrical information, well-ordered preferences and unlimited capacity to calculate costs and benefits to maximise expected returns (Gibson *et al*., 2005). This would best describe a condition of an ideal world, but is rare in the actual world. Hence, like many empirical studies that study real-world cases, analysis of the allocation of mitigation finance may not meet the second condition of the economic model of rational behaviour. As discussed earlier in this chapter, it is likely that there is an asymmetry of power and knowledge among climate mitigation actors, notably between donors and recipients but also between large and small poor developing countries. There is also limited capacity for calculating the costs and benefits of mitigating emissions. Many researchers face limitations to acquiring information and hence tend to make different assumptions resulting in their arriving at varying estimates of the benefits of benefit and costs of mitigating emissions (Neumayer, 2007).

The previous chapters are essential elements of the IAD framework in the context of mitigation finance. They feed into the two main institutional analyses in this chapter, which aims at improving understanding of the effectiveness of mitigation finance allocation. The first analysis focuses on mitigation finance as a perceived incentive for developing countries to join the global mitigation action; the second discusses the conceivable outcomes of mitigation finance as an international institution fostering global collective action to mitigate the world's GHG emissions.

5.3. Is mitigation finance a perverse incentive?

From the perspective of institutional theory, *incentive* refers to benefits corresponding to the actions of a party (Gibson *et al.*, 2005). Mitigation finance can be an incentive that steers the recipient country's decision to follow the donors' intended actions such as when donors can impose a condition to pass a specific policy or regulation as a condition on aid disbursement. However, mitigation finance like other aid more broadly can also act as a perverse incentive with counterproductive outcomes (De Soto *et al*., 2003) such as creating aid dependency (Moyo, 2009).

As an environmental, economic, development and political instrument, mitigation finance has both normative and positive values. The normative value of mitigation finance prescribes how such finance should be allocated to mitigate developing countries' GHG emission reduction, while its positive value informs actual practice, such as how it is allocated, managed and used.

5.3.1. Normative values of mitigation finance

Normatively, the donor should allocate mitigation finance effectively, to the right place at the right time, to developing countries with high GHG emissions, hence addressing large-scale emission reduction or large areas of forest or any other form of carbon sinks that absorb and store a large quantity of carbon emissions.

Following the donor's allocation, the recipient country should spend its mitigation finance wisely and responsibly. The responsibility of recipient governments covers activities such as regulating the administrative aspects of mitigation finance such as the rationalisation of spending per item, controlling effectively the use of mitigation finance for climate mitigation projects and activities and informing the donor of how it is being used and the outcomes of funded projects.

Empirical studies of foreign aid show that donors like Australia, France, Italy, Japan and the US are influenced by their own political interests, such as supporting ex-colonies and allies, in the allocation of aid (Berthélemy, 2006). These positive evaluations of foreign aid indicate that donors can take advantage of foreign transfers for their own maximum gain. When the allocation of mitigation finance is not transparent, and transparency is not mandatory, donors have the opportunity to offset their responsibility for reducing emissions at home elsewhere, i.e. on developing countries.

As with foreign aid, mitigation finance has two inherently contradictory attributes which can make it a perverse incentive and, as (Moyo, 2009) calls it, 'dismal relief'. The main objectives of mitigation finance are to reduce developing countries' GHG emissions and improve their economic development, but donors can use it as an economic and political instrument. The recipient government can also utilise mitigation finance to improve its economy and shift its development activities toward a low-carbon economy. When mitigation finance is given in the form of budget support, its recipients can misuse it to increase their national reserves by not spending it immediately; in the worst case it can be appropriated for personal use. The degree to which either side is a dominant influence depends on donor's strategic direction.

Since the early history of foreign aid, when donors' own political interests influenced their allocation of foreign aid, its outcomes have been associated with perverse incentives for the recipients (Morgenthau, 1962) such as supporting corrupt officials in power and creating aid dependency (Svensson, 2000a; 2000b).

However, foreign aid can also be allocated to solve the collective problem of transboundary pollution and simultaneously satisfy a region's collective needs. Lahiri and Beladi (2007, pp. 85–103) explain theoretically how aid provision stimulates competition for pollution abatement between neighbouring countries. Foreign aid has been shown to be an effective tool for rewarding developing countries that are willing to mitigate transboundary pollution. Lahiri and Beladi explain that competition for foreign aid among aid-receiving countries eventually reduces regional pollution. It cannot be denied that within the normative objective of mitigating pollution it is in the donors' interests to protect themselves from the threats inherent in the collective problem of pollution. In this instance, the donor aims to protect its own citizens' health from being affected by pollution from neighbouring countries. This competition-based aid policy has the potential to facilitate a mutual donor-recipient relationship with reciprocal benefits and to solve the collective problem.

One should be aware that the outcome of collective regional action may differ from global collective action to mitigate GHG emissions. Sandler (2004, pp. 212–234) argues that two global pollution problems caused by different emission substances may involve different levels of challenge. The world has made considerable advances in curbing ozone-depleting substances (chlorofluorocarbons and bromide-based substances), but little has been achieved in mitigating GHGs (*ibid*). Two reasons for this are the greater cost than benefit of mitigating GHG emissions and the uneven negative impact of climate change across countries and time periods

(Reilly *et al.*, 1994). For a certain period of time some countries will be able to benefit from warming temperatures boosting the yields of certain varieties of crops (*ibid)*. Whereas the benefit of mitigating depleting substance is greater than its costs and negative impacts, such as skin cancer as a result of ultraviolet radiation. Without an ozone layer all countries will suffer equally, regardless of their locations.

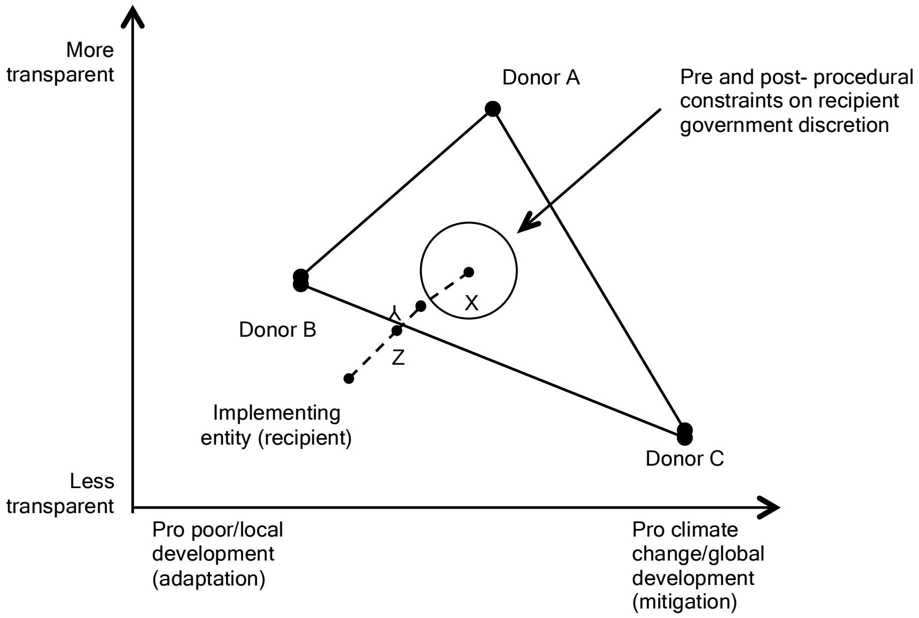
5.3.2. *Positive values of climate mitigation*

Studies show that foreign aid is also determined by positive values. Its allocation steers developing countries' policies in directions less relevant to the objective of the aid such as promoting ideology, fighting terrorism, expanding the donors' volume of trade and creating opportunities for recipients' military expansion (Clist, 2011; Fleck & Kilby, 2010; Khilji & Zampelli, 1994; Suwa-Eisenmann & Verdier, 2007). Mitigation finance as foreign aid may be influenced by these positive values. There are links between climate change and international trade such as increased competitiveness and the creation of trade barriers and opportunities (Brack *et al.*, 2000). When donors perceive certain opportunities such as benefits from carbon offsetting and trade, donors can utilise mitigation finance to accelerate the expansion of global carbon market.

Other factors make foreign aid a perverse incentive. Disparities in knowledge and access to information associated with a principal-agency problem is one perverse quality in foreign aid (Marcoux & Tierney, 2011; Nielsen & Tierney, 2006). In the case of mitigation finance, the principal-agent problem is likely to persist due to several factors: first, there are different vested interests and conflicts in the objectives of the donor and the recipient (Martens *et al.*, 2002, p. 34). These conflicts also occur at the national and operational levels such as between project managers and officers.

Figure 5.2 illustrates how recipients, as implementing agencies which maybe have different policy preferences to those of the donors, have the power to drift away from the donors' original intent. As an illustration, the donors' original intent may lie on point X, which addresses mitigating climate change and improving the wellbeing of poor people relatively equally. Donors may also have a standard of transparency, whereas in practice implementing agencies are less transparent than the donors would wish.

Figure 5.2: Principal-agent relationship within donor and recipient governments



Adapted from Hix (2005, p. 30)

When a coalition of donors, A, B and C, and a recipient government agree to implement a climate project, e.g. an alternative energy or wind-power project, an objective is set at point X. To limit potential change to the intended outcome the donors may introduce a set of procedural constraints such as the Rio Marker objectives and an MRV system as a post-procedural constraint to limit the discretion of the recipient government. In Figure 5.2 this procedural constraint is represented as a circle in the middle.

In many situations donors rely on reports submitted by the implementing entities operating in the recipient country. Although the implementing entity has very limited political power, it has considerable administrative power to allocate resources, including planning the budget and regulating spending (Hix, 2005). With this it is possible that the entity, which may have an aspiration toward pro-poor policy and may be less transparent, drifts away from the donors' original intent to mitigate emissions and be transparent towards pro-poor policy and less transparent practices.

This illustration may further explain one of the most commonly-discussed issues within the framework of classical public choice theory: in many cases mid-level officers of an implementing entity maximise the budget to increase their salaries and can reveal or retain information that protects the pursuit of their own interests. As shown in Figure 5.2, when the personal aspirations of mid-level officers are in favour of pro-poor policies, in other words, the officers perceive mitigating global emissions as less relevant to poverty alleviation (Ansuategi & Escapa, 2002); with their power and interest in supporting pro-poor development, the officers may arrange daily expenditure that is closer to their ideal interests. Hence the intention of the donors at point X is drifted toward the implementing entity's ideal point. However, the implementing entity reports and allows the objective to drift only up to the point acceptable to the donor at point Z bypassing the procedural constraint they have set at Y (so-called bureaucratic drift). It is mainly because mid-level officers are also aware of the possible suspension of financial inflows due to misalignment between the donors' intended outcomes and the implementation. Therefore even if a recipient country has ratified a climate change treaty and taken action to reduce its emissions, disparities in or misalignment of information between the donor as the principal and the recipient as the agent can lead to a situation where mitigation finance results in unintended outcomes.

5.3.3. Is mitigation finance less perverse than non-mitigation ODA finance?

In general numerous rules are introduced to control the social behaviour of the actors in the delivery of mitigation finance. There may be considerable effort on the donor's part to encourage other countries to formulate and agree upon measures and safeguarding policies to ensure that the mitigation finance will have the intended outcome. Perhaps donors are pressurised by future risk of exposure to negative impacts of climate change. In addition, under the Kyoto Protocol regime donors experienced an imbalance in the responsibility for mitigating emissions as developing countries were not legally bound to targets while the donors made their first step to commit to legally binding targets under the Kyoto Protocol. In the face of these natural and institutional pressures formal and defined rules, principles and implementation guidelines are necessary, such as the Bali Road Map, nationally appropriate mitigation actions (NAMAs) and guidelines for land use, land-use change and forestry (LULUCF). These safeguards and standards were designed to narrow bureaucratic drift in mitigation finance distribution caused by the agent (recipient) moving away from the intended objectives of the principal (donor).

Pressure for more institutional gatekeeping might also come from the aspirations of the citizens of donor countries. Compared to other forms of aid, mitigation finance has the unique purpose of benefiting all people on earth, including the taxpayers in the donor countries. As the principal donors who pay for foreign aid, taxpayers have an incentive to urge their governments to monitor the use of mitigation finance. They see the need to ensure the effective delivery of mitigation finance since its misuse can have negative implications that directly affect them.

Of all types of aid, climate change is the only category which recipients and donors are both obliged to consistently record, code and report their funded projects according to criteria specified by international treaties (Tirpak *et al.*, 2010). Mitigation finance also has more institutional gatekeepers. A growing number of independent monitoring bodies such as the World Resource Institute (WRI), the Overseas Development Institute (ODI), Aiddata, Climate Finance Options and WeAdapt devote their research to evaluating the effectiveness of climate finance.

These extra safeguards and gatekeepers monitoring the implementation of climate change projects tend to be absent in the implementation of most other aid projects. Although climate and mitigation finance include all these precautionary attributes there is no guarantee that they will eliminate its potential for perversity. With or without such frameworks there is still potential for mitigation finance to work against its objective and lead to higher emission levels.

5.3.4. Does mitigation finance increase emission levels?

One reason why mitigation finance can result in a counterproductive outcome is that when development agencies have not adopted environmentally-friendly regulations, their officials may have an incentive to act in ways that are harmful to environment. For these agencies, receiving more mitigation finance tends to intensify non-environmentally-friendly development activities that eventually lead to environmental degradation (Duraiappah, 1998). Development agencies' existing technical and internal policies, i.e. concomitant accounting procedures and policies were established before the appearance of mitigation finance. If they are not adjusted to low-carbon based policies there is a danger that the increasing number of development activities funded by mitigation finance will increase developing countries' GHG emissions in the short term, although it would lead to a slower future rate of increase in the long term (known as a rebound effect).

One such example is international development agency policy that contradicts mitigation finance objectives. It is common to provide staff with a stipend if they have to travel more than 50 km for a meeting. Reflecting public choice theory (Vaubel, 1986), officers pursue policies that maximise their income and hence officers will choose a meeting location well beyond this distance to obtain the stipend. With this arrangement, they and all the other meeting participants have to travel longer distances, producing more GHG emissions. So it is possible that more climate change projects in developing countries without a green reform of the internal policy of their development institutions will increase rather than reduce GHG emissions. There is also concern about the growing numbers of delegates at international climate change negotiations and meetings; for instance more than 40,000 people registered for COP 15 in Copenhagen, creating massive logistical problems (Bodansky, 2010b). International activities addressing climate change tend to be harmful to the environment as they create waste and logistical issues and encourage long-distance travel. The intensity of travelling can be reduced by utilising online-based technologies to accommodate certain types of meetings.

Developing countries' dependence on incoming mitigation finance may also lead to increased emission levels when the amount given by donors increases with the higher emissions they generate. Recipients may therefore delay the implementation of mitigation measures and committing to legally binding targets. When there is no penalty for no commitment, it is possible that they will merely state that they are committed to reducing emissions but postpone its implementation. Thus mitigation finance can become a perverse incentive when it appears to reward recipients with more emissions with more funding, leading to a dependency problem.

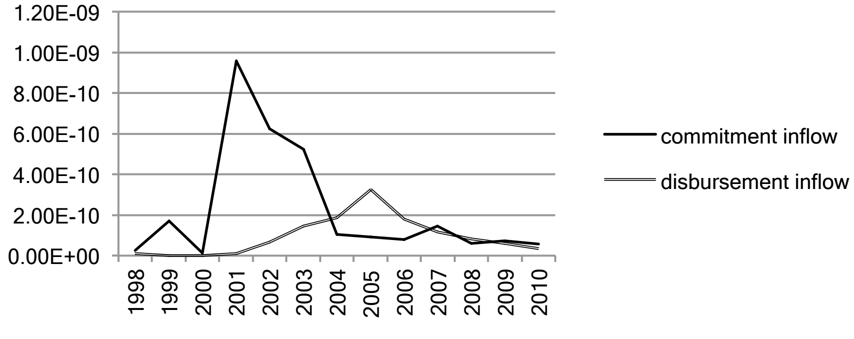
As explained, considerable efforts have been made to make mitigation finance less perverse. The degree of influence of institutional boundaries on the behaviour of public officials call for scientific and academic community's evaluation. It is also important to evaluate the extent of bureaucratic drift in the presence and absence of and in different settings related to the system that is monitoring and evaluating mitigation finance (Martens *et al*., 2002, p. 154).

5.3.5. A small amount of mitigation finance: attractiveness and scalability

Compared to the total GDP of large developing countries, mitigation finance inflows to these countries are relatively insignificant, but its scalability and its subsequent opportunities can be an attractive incentive for large developing countries to involve themselves in global emission mitigation. For example, mitigation finance inflow to China is minimal at less than 0.0001% of its GDP (see Figure 5.3). Considering the scale of China's domestic emissions they can only be reduced if its government decides to pursue low-carbon economic growth. China's ratification of the Kyoto Protocol on August 30 2002 coincidentally followed an increase in donors' commitment to provide China with mitigation finance (Figure 5.3). Recently, due to the potential of negative impact of climate change on China's long-term economic growth, its government has started pursuing a friendlier environmental policy (Harris, 2011) including issuing 'wind bonds' to finance alternative energy projects (Kidney, 2013).

For a large country like China, mitigation finance may not be a significant incentive, but China and other major economies have gradually shown willingness to formulate and implement domestic policies to reduce their emissions. China and India have adopted carbon intensity targets because the negative effects of climate change are now threatening their national security (Moran, 2011, pp. 81–82).

Figure 5.3: Share of mitigation finance inflow to China relative to its GDP



Data Source: OECD (2012a); WDI (2013)

Existing mitigation finance is mainly used as seed money to set up national mitigation finance institutions and mobilise private funding for emission reductions on a large scale (Ong & Inance, 2013). For example mitigation finance is given to Indonesia to support the establishment of a nationally-managed climate change trust fund (UNDP Indonesia, 2012) which is expected to expand the absorptive capacity and delivery of mitigation and other types of climate finance, along with the enhancement of national ownership of foreign aid.

On a broader scale than that of official aid there are also ground-breaking movements to propel its large-scale sustainable provision of climate finance form private sources (Bracking & Ganho, 2011). The targeted communities are global financial markets, global private corporations, NGOs and global business leaders, which are expected to incorporate aspects of environmental sustainability in their policies and strategic decisions. In light of this movement, a number of financing initiatives are emerging such as climate bond initiatives commissioned by HSBC (Oliver *et al.*, 2013). There is slow but steady progress in mobilising private finance as climate finance, including mitigation finance, and formally counting and tracking it. This increasing financial mobility is an attractive feature of mitigation finance for countries interested in trade associated with mitigating climate change, such as carbon markets.

5.4. Mitigation finance: transitory or permanent?

The amount of funding mobilised to finance global emission mitigation is still limited and insufficient; hence mitigation finance is taken from ODA and established as a transitory arrangement to fill this financing gap as so-called fast-start climate finance. The Copenhagen Accord expected donors to mobilise US$30 billion as fast-start climate finance in 2010-2012 (Stadelmann *et al.*, 2010). However, in 2012 mitigation finance was still primarily being sourced from ODA (Nakhooda *et al.*, 2013). This section gives five reasons why the transitory mitigation finance arrangement has the potential to become a permanent arrangement attached to ODA.

The first reason is the dual benefits of mitigation finance as the result of mainstreaming it into the global development agenda (Klein *et al.,* 2005), Donors can argue that its successful outcome will result in development benefits such as improving income and creating job opportunities in developing countries. Thus mitigation finance delivers a dual objective, making it acceptable for donors to use ODA as mitigation finance whose outcome is aligned with ODA's traditional objectives of alleviating poverty and improving the economies of developing countries. Opposing the idea of mainstreaming, Gupta (2009) argues that in certain political circumstances such as difficulties with integration of development and climate mitigation activities by developing countries unfamiliar with climate change issues this mainstreaming tends to have a negative impact on the poor and alienates developing countries.

The second reason is the length of time it takes for UNFCCC negotiations to deliver tangible outcomes (UNDP, 2011, p. 13). This will prolong donors' use of ODA for mitigation finance. Adopting a policy and making decisions require a minimum two-thirds majority vote (Depledge, 2005, p. 98). When the supply side is inhibited by various political motives, the supply will be scarce and in the urgent situation, the donors will be inclined to use whatever resources are available. ODA seems to be an accessible funding source and in the absence of alternatives that are able to provide a similar amount, there is a great possibility that donors will continue relying on ODA as the main source of mitigation finance.

As a new international mitigation finance institution, the establishment of the Green Climate Fund (GCF) took longer than expected. Since its establishment in 2009, the GCF has not made significant progress in fundraising and distributing climate finance across developing countries. Its projected expenditure by December 31 2013 is US$ 6,526,525 (GCF, 2013). Mitigation finance will continue to use part of ODA to fill this institutional gap until the GCF shows its ability to fundraise and distribute bilateral funding as much and as fast as current bilateral transactions.

The third reason is the slow progress of DAC donors in reaching the target of 0.7% of their GNI as ODA. Donors who have not achieved it are inclined to include their mitigation finance contribution as part of their ODA. As mentioned earlier, only a handful of donors have exceeded the 0.7% target. By including mitigation finance, donors can demonstrate their ODA growth and create the impression that they have fulfilled the 0.7% target. Concrete evidence of this is provided in the form of the *Global Energy Efficiency and Renewable Energy Fund* (GEEREF), a financial instrument formalised as a public private partnership (PPP) whose funding provision and allocation is categorised as ODA (EU, 2006).

The fourth reason is possible path dependency on the existing operational mechanism under international climate change policy (Skodvin, 2000, p. 10). To date there has not been a robust alternative system to replace ODA (*ibid*) and there is doubt about whether a new financial arrangement would be able to effectively deliver a large amount of mitigation finance in the short period of time (VanKerkhoff *et al.*, 2011). One of the proposed solutions is to channel mitigation finance, and climate finance in general, through newly-created institutions or nationally-managed organisations such as trust funds and green social enterprises (Karmali, 2013). However, there are considerable capacity issues including inexperienced funding management and asymmetric information and understanding related to climate change and technical knowledge (Gupta, 2009). The hesitation about using current institutions and the lack of ability of new institutions slow the process of fundraising and generating new funding sources for mitigation finance, and therefore mitigation finance is likely to continue to rely on ODA as its source of funding.

The last reason is that as a relatively new foreign aid category, mitigation finance may become permanently attached to ODA to continue incentivising businesses and the private sector to invest in climate change projects. There is growing demand for investment in alternative energy and transportation, but these involve considerable regulatory and financial risks that mitigate the commercial viability of a climate project and prevent investors taking major steps. Similarly, in the forestry sector forestry programs can generate considerable certified emission reductions (CER) in the CDM market. However, the lack of credibility of its mechanism for enforcing implementation is still a major issue. Currently there is little assurance that investment in climate projects will be profitable in the long term.

Considerable efforts have been made to mobilise mitigation finance and other climate finance from sources other than ODA, yet some of the challenges outlined above, such as limited resources for funding, the unmet overall ODA target, the absence of funding transfer mechanisms that are larger and faster than ODA, risks and uncertainty, and slow international policy negotiations maintain the existing institutional arrangements for meeting the pressing need for mitigation finance transfers. With private finance not yet responding to or meeting the global need to finance the world's GHG emission reduction, there is a strong likelihood that ODA will remain an important source of mitigation finance and continue to be a financial instrument catalysing various financial sources with the aim of achieving the global target of limiting the global temperature increase to below 2°C above preindustrial levels.

5.5. Mitigation finance: donor or global collective action?

Mitigation finance is still predominantly donor-driven. Although commitments to taking action on climate problems have recently intensified on the part of developing countries, much of the overall provision of mitigation finance still largely depends and relies on a few donor countries (Barder *et al.,* 2013; Nakhooda & Fransen, 2013).

Mitigation finance has gradually allowed developed and developing countries to jointly tackle the boundaries and the technical and financial barriers to mitigating developing countries' national emission levels. Developing countries have slowly begun to collaborate in mitigation projects, but it is too early to claim that mitigation finance has taken the form of global collective action. Currently developing countries mainly host climate projects. There are some initiatives to promote financial and knowledge transfers between southern developing countries, but such south-south cooperation is still in its infancy (Quadir, 2013).

The participation of developing countries in mitigating global emissions is a pre-requisite for global collective mitigation action. Miller (1992) explains that collective action requires the input of several actors for the desired joint outcome. In the case of mitigation finance, the input or provision of the finance is still insignificant and heavily relies on just a few donors. The global structure of mitigation finance that governs its provision and allocation is still tenuous and fragmented. Reliance on this small group of donors will have major consequences for the continuation of this global collective effort if the major donors are affected by serious challenges that force them to cut their global climate budgets, such as an economic crisis.

Reliance on a small group of donors for mitigation finance threatens the reduction of global emissions in the long term due to imbalanced responsibilities that tend to be unsustainable. This heavy reliance also demonstrates that the UNFCCC negotiations have not yet resulted in a system that works on equitable principles, sharing responsibility between countries according to the quantity of their emissions (UNFCCC art. 1). In current practice there is an imbalance between the economic and political power that influences international climate change negotiations, responsibility for emission levels and financial contributions to fund climate actions. For example the US, which has an influential voice in the negotiation arena and also considerable responsibility due to its high GHG emissions, is not party to the Kyoto Protocol and up to 2010, it made a relatively small contribution to the global pool of mitigation finance. The equitable principle stated in the UNFCCC art. 1 is the key to unlocking the possibility of mitigation finance and pave the way for global collective action, yet much of the emphasis on equitable global collective action remains rhetorical, and it is politically difficult to operationalise, agree and implement. This raises questions about how long the current system will be able to accommodate the imbalance of power, responsibility and contribution.

The equitable principle in the mitigation of global emissions and responsibility for financing it will remain disputed and unresolved if (1) there is a lack of agreement about whether historical emissions are to be counted as part of developed countries' responsibility; (2) methods for quantifying and converting responsibility for emissions into tradable commodities are still in dispute; (3) major private companies remain absent from UNFCCC negotiations; and (4) there is no system to facilitate private companies' commitment to targets for emission reduction and directly contribute to the global pool of mitigation finance and to report their progress.

The future of mitigation finance depends on the contribution and financial supply of not only developed countries but all the countries on Earth. With the vision of mitigation action as a pool of joint contributions from both developed and developing countries, this thesis has made fundamental inquiries and asked several challenging questions, the answers to which are expected to improve global collective understanding of how mitigation finance is allocated to developing countries where there is an imbalance of power, responsibility and contributions between them and developed countries. At this early stage in the development of global mitigation finance, this research has been able to identify key determinants of mitigation finance provision and allocation that were unclear to many countries. These determinants represent the criteria set by a small group of donors to respond to global collective mitigation action, which symbolise their strategic direction in responding to multidimensional challenges of mitigating emissions and, to a lesser extent, to alleviate poverty in developing countries, as well as enhancing global action in mitigating carbon emissions. This thesis's findings have contributed to uncover some of unreported determinants of official mitigation finance. Expectedly this information will balance asymmetric information between donor and recipient countries and will accelerate their cooperation in mitigating global emissions.

To promote further cooperation between developed and developing countries, there are still plenty of tasks for the academic community to help promote global collective mitigation action. One of the urgent needs is to evaluate the impact of mitigation finance and investigate the extent to which it has mobilised national financial resources in developing countries, such as the proportion of national revenue (non-aid budget) that has been spent on funding abatement activities. These evaluations will also make an important contribution to evidence of developing countries' participation and support the establishment and formation of mitigation finance as global collective action.

5.6. Conclusions

Theoretical studies of mitigation finance are still limited in number. Much policy discussion is devoted to prescribing how it should be allocated more effectively. This chapter's reflective approach has shown how a discussion based on institutional theories helps to clarify how mitigation finance can become a perverse incentive. It is possible that developing countries are perversely incentivised to postpone adopting policies that support national emission reduction programmes in order to continue receiving mitigation finance. Hence an increase in the level of emissions in a developing country that is followed by an increasing inflow of mitigation finance may not result in an immediate decrease in its emissions.

Mitigation finance has the potential to be permanently reliant on ODA if international climate negotiations do not result in a solid global collective agreement on how to finance the mitigation of GHG emissions in developing countries. As long as only a limited amount of mitigation finance is sourced from developing countries' national budgets and the rest is dependent on ODA's success of mitigation finance in solving global GHG emissions will be limited, and to a large extent will remain a donors’ rather than a collective global action.

6. THE FUTURE OF CLIMATE MITIGATION FINANCE

6.1. Conclusions

In the past decade donors have reacted promptly to unprecedented global environmental distress by directing part of their ODA towards the mitigation of climate challenges. The increasing share of ODA allocated to financing climate projects in developing countries globalises the benefits of foreign aid, protecting all countries, including the donors, from the catastrophic effects of climate change.

Riddell (2007, p. 1) states:

> *For both individual donors in rich countries and for their governments, foreign aid has always been viewed as a moral issue. Yet the benefits and virtues of aid have always been contested and challenged.*

Donors and recipients of mitigation finance formally share the benefits of foreign aid as both are entitled to them. This entitlement, status and sharing of the benefits of ODA, whether for its recipients or for global development and protection, and whether it can be considered 'aid', are still debatable. In this uncertain situation, this thesis has tested for the influence of numerous factors representing donors' and recipients' characteristics regarding mitigation finance provision and allocation. The findings show that its provision is influenced by donors' emission levels, CO_2 intensity per GDP, commitment to the Kyoto Protocol, good governance, political view, domestic environmental spending and size of population, while its allocation is influenced by the recipients' performance and developmental needs, the donors' interests and also, uniquely, by climate mitigation indicators, which impact on the global temperature and the Earth's climatic conditions.

These dynamic determining factors are accelerating the evolution of the role of foreign aid as a development instrument (Tarp & Hjertholm, 2000). When foreign aid is allocated as mitigation finance, a pragmatic compromise is made so that this relatively new type of foreign aid accommodates both local and global development. Hence there are expectations that foreign aid produces outcomes with shared global benefits. In traditional ODA, good governance is an important major condition of aid's effectiveness in reducing poverty (Collier & Dollar, 2002). For mitigation finance, governance alone is rather insufficient. To meet the collective expectation of fewer global GHG emissions, developed and developing countries must mitigate their national emissions simultaneously. If mitigation finance is successful in reducing GHG emissions in just a few developing countries while the majority continued to pollute, such aid will be ineffective since overall, emissions are not decreasing but increasing.

The challenges to be faced if mitigation finance is to meet its intended outcome are greater than those of traditional ODA. With its expected goal conditional upon the success of global collective action there are additional informal challenges inherent in incentivising developing countries to participate in such global collective action. As a relatively new and growing category of foreign aid, mitigation finance has multiple roles at different levels of policymaking. Its allocation across developing countries is expected to not only tackle multi-dimensional issues arising from interactions between environmental, economic and institutional development problems but also to act as a catalyst to solutions to the pressing global need to respond to the changing climate.

The roles of ODA are evolving along with its increasing allocation to mitigation finance as a response to shifts in the development paradigm. Since the success of ODA after World War II in delivering the Marshall Plan, which resulted in Europe's fast physical and economic recovery, the provision and allocation of ODA have been determined by a changing set of determinants representing the evolution of the development paradigm. Foreign aid has supported projects in different contexts such as infrastructure development and human resource capacity-building during the financial push paradigm of the 1960s, income redistribution together with support for social development, health care and education during the socio-economic paradigm of the 1970s and '80s, market liberalisation and structural adjustment to international trade and financial markets in the late 1980s and early 1990s, and improving governance in the late 1990s and early 2000s (Kremer *et al.*, 2009; Marshall, 2008).

Development has recently entered a new phase in which climate change is perceived as a potential threat to development and therefore measures to mitigate its worsening effects are being mainstreamed into the global development agenda (Klein *et al.*, 2005a). A fast-track mainstreaming process has led to a new development paradigm whose form does not separate local from global development. With the gradual dissolution of such boundaries global benefits may become more dominant, detracting from ODA's local benefits as development becomes more global and greener.

If foreign aid becomes global property, some questions about its values and ethics (Chatterjee, 2004) will need to be answered. Are global or local needs more important to foreign aid? Whose interests are becoming more dominant, the donors' or the recipients'? Perhaps there are no direct answers to these challenging and fundamental questions. To open the way to answering them in detail, this thesis has examined the allocation and provision of mitigation finance globally across donors and developing countries.

The thesis has produced insights into the relationships between the provision and allocation of mitigation finance and the characteristics of donors and recipient developing countries. Chapters 2, 3, and 4 empirically studied the determinants of the provision and allocation of mitigation finance across donors and developing countries. Conceptual discussion elucidated the possible consequences and implications of this relatively new foreign aid policy, which is formulated to respond to the changing global climate – the problem with the level of difficulty and the complexity that has no parallel to any development problem that humankind has faced before.

A great number of empirical studies have tested whether the normative objective of aid - to alleviate poverty - is used as the determinant of development aid allocation. Contributing to this body of literature, the empirical studies in this thesis follow the intention of studies on aid more broadly by testing whether the objective of mitigation finance - to mitigate GHG emissions in developing countries is used as the determinant of the allocation of mitigation finance. There is an argument that as the normative objective of mitigation finance this may divert ODA from the broader initial objective of foreign aid: the alleviation of poverty. The empirical studies in this thesis have shown how both the specific objective of mitigation finance and the general normative objectives of foreign aid influence the allocation of mitigation finance across developing countries. This evidence is used as a point of departure from which to discuss the theory of aid allocation and evaluate the direction of foreign aid allocation in response to the changing global environment.

Chapter 2 has demonstrated how donors’ domestic performance on environmental issues tends to influence the share of mitigation finance in their total aid provision. There is competition for financial resources between domestic and overseas environmental spending, with higher share of environmental spending in total of donor’s domestic expenditure negatively affecting the share of mitigation finance in donor’s aid provision. Conversely, donors’ regulatory quality, control of corruption, voice, accountability and rule of law positively influence the share of mitigation finance in total aid provision, while political stability, government effectiveness and level of income per capita have no relevance in determining a donor’s provision of mitigation finance. Chapter 3 has shown that there are strong associations between the allocation of mitigation finance and selected variables representing global needs, and a moderate association with recipients’ needs and performance. Chapter 4 has discussed how specific donors’ allocation of mitigation finance is strongly associated with their own interests. Chapter 5 has used the findings from the three previous chapters as the foundation of a conceptual discussion on the evolution of aid allocation theory.

The empirical evidence shows that global needs influence the allocation of mitigation finance. This evidence challenges accepted theories of foreign aid. First, most aid studies assume that in aid there is a distinct division between the benefits aimed at the recipients and the donors’ desired side benefits, and that there is a lack of emphasis on sharing the benefits of aid. Once it is received, aid is assumed to be the domestic property of the recipients. In the assessment of general aid there is a lack of recognition of the importance of environmental factors. Most econometric assessments of foreign aid allocation assume the variability of environmental aspects as constant. This thesis starts with an assumption that climate change influences the allocation of aid to address global development problems. Chapters 2 to 4 investigated a set of variables representing a set of donors and developing countries' characteristics, including attributes related to climate change, namely environmental budget, CO_2 emission levels, other GHG emissions, CO_2 intensity, deforestation, and forest cover.

The second assumption of some of aid effectiveness studies is that alleviating poverty is the primary objective of aid. There is lack of acknowledgement of its global benefit, which has the potential for diverting ODA from this objective of ODA (Michaelowa & Michaelowa, 2007a). Chapter has 5 evaluated this possible divergence of the normative objectives of foreign aid. Most aid studies show how recipients' needs, recipients' performance, and donors' interests influence aid allocation. Chapter 5 analyses the changing and additional roles of mitigation finance in fulfilling its normative objective. The increasing amount of ODA includes mitigation finance as a new sub-category of ODA with a distinct objective. Previously, donors' interests were moving closer toward meeting the recipients' needs (McGillivray, 2003). With the addition of global needs it is possible that the direction of donors' interests is moving away from meeting recipients' needs towards meeting global needs.

The findings of this thesis, and particularly those discussed in Chapters 3 and 4, show evidence of the influence of recipients' needs and global needs on mitigation finance allocation. These empirical findings provide the explanation that donors' allocations are shared between meeting the global normative objective and supporting recipients' needs. Chapter 4 has demonstrated the significant influence of the interests of several donors in their allocation of mitigation finance. These donors are inclined to allocate mitigation finance to countries in which their CDM investments are located, expanding their own access to territory on which to offset their GHG emissions. Although there are early indications of this pattern shifting to support the global objective, overall, donors have considered recipients' development needs. Chapter 3 has shown that infant mortality is still a positive significant influence on total ODA allocation, and that countries with lower per capita income receive larger amounts of mitigation finance. In sum, the increase in mitigation finance has indicated the possibility of ODA's response to local needs being diverted to mitigation finance's response to global needs. Nevertheless, the growth of mitigation finance has not yet diverted the ODA's objective of alleviating world poverty.

The findings in Chapter 3 have also shown that donors respond differently to different types of GHGs and of financial instruments. Gases with greater global warming potential (GWP) are more sensitive parameters of mitigation finance allocation. Loans are given to fund climate projects in countries producing substantial CO_2 emissions, while grants are targeted at countries with large forested areas. Donors use different measures and financial instruments to mitigate different aspects of global CO_2 emissions which indicate their strategies for avoiding the negative implications of rewarding large polluters with international finance.

When the global normative objective has less obvious benefits and is not in alignment with recipients' needs, donors and their foreign aid have to persuade recipients to take joint responsibility for mitigating emissions and performing well in their execution of projects aimed at meeting the global normative objective. If the incentive is unclear, recipients' commitment will vary according to how mitigation finance is used as an incentive in international climate change negotiations, but will also depend on other unpredictable factors. There is a danger that spontaneous pledges of mitigation finance, without first thoroughly identifying which countries should be prioritised to receive mitigation finance, will lead to an inherent problem of the incentivisation of recipients to maintain or increase their emissions and damage the global environment further. This thesis contributes to the conceptual development of foreign aid allocation and to more informed policymaking regarding the allocation of global mitigation finance.

6.2. Policy implications and recommendations

Providing and allocating mitigation finance to support developing countries' emission reduction has socioeconomic, institutional, environmental, moral and political consequences. Below are some of the policy implications of mitigation finance allocation and some policy recommendations that require further verification and examination.

6.2.1. Socio-economic consequences: disparities of income between rich and poor

A prolonged and heavy concentration of mitigation finance in developing countries with substantial emissions would crowd out foreign aid for poor countries and widen the disparity between their incomes. When reducing emissions is prioritised over alleviating poverty, for instance to improve efficiency in the energy sector, a large amount of mitigation finance is allocated to large companies and businesses in developing countries. Although these companies may receive only loans, rather than grants, this financial capital will be concentrated amongst people with higher income levels. A guiding UNFCCC principle states that climate finance, including mitigation finance, should be regulated on an equitable basis. However, it does not specify whether such companies must distribute the mitigation finance they receive to people in their country with low incomes.

A cap on foreign aid as mitigation finance could be introduced to prevent this negative socioeconomic consequence, particularly for donors who have not yet met the target of 0.7% of GNI as aid. In the context of building an agenda for a global development assistance and climate fund, the OECD and the GCF have brought the donors and some developing countries together. They can facilitate a discussion to set a cap of the proportion of climate mitigation finance in total ODA. Rather than being set arbitrarily, a cap on the allocation of aid to mitigation finance can be built upon a rigorous study such as that of Wood (2008); this kind of study shows a set of scenarios of optimal allocation of aid to achieve its poverty and emission reduction goals. This evidence-based approach to setting the cap may avoid the possible diversion of resources when climate change mitigation is not the primary overarching objective of development aid.

As the ODA also funds development projects that are mainstreamed into climate change it is important to clarify which types of project are eligible for mitigation finance and which are not. The Rio Marker objectives have provided generic guidance on this matter; however, there is insufficient explanation, such as through examples of good and of false coding practices. There is also an absence of independent parties' evaluation and verification of the reported Rio markers.

6.2.2. *Institutional consequences: scaling up, absorptive capacity and the commitment-disbursement gap*

The ambitious plan to scale up mitigation finance to US$ 100 billion a year by 2020 is a challenging target from the perspectives of both supply and demand.

The world assumes that a sufficient amount of mitigation finance to fund climate project is US$100 billion per year. Currently the volume of mitigation finance is still well below this amount, and a considerable effort is required to mobilise sources of finance to raise the supply and to set policies that make it more elastic in terms of its transaction cost so that it reaches the US$100 billion as the global need or global financial demand in mitigating carbon emissions. The supply curve becomes more elastic when there are more funding options for mitigation finance. It is likely that the transaction cost elasticity of mitigation finance will be greater in the long run because more donors from different sectors (private and NGOs) contribute to the global pool of mitigation finance. The transaction cost of delivering mitigation finance is also likely to drop if more donors can finance and co-finance larger-scale projects in developing countries that have the capacity to receive it. To reduce the cost and improve the absorptive capacity of developing countries to receive mitigation finance, the demand side also requires attention.

Managing demand and spending US$100 billion per year effectively depends on the recipients' ability and capacity. They must build their capacity to disburse and distribute received funding to the areas that contribute most to global GHG emissions. When funding received is not spent it acts as the recipients' savings, becoming an idle and unproductive pool of money or, worse, is appropriated by corrupt officials. To avoid this, effective spending must be supported by effective planning that is coherent with national development priorities and the national financial management system and translated into the efficient execution of the plan.

The 2009 Copenhagen Accord states the amount needed globally is US$100 billion per year. This target is not yet supported by global and national assessment of the ability and capacity of the majority of countries to effectively spend and efficiently utilise mitigation finance in the execution of climate-related projects. Nevertheless the Accord does not prescribe how to achieve this financial need. Currently recipients' demand falls below the amount of mitigation finance that donors are able to supply. This difference in the amount of mitigation finance provided by donors and the amount that can be managed by the recipients remains one of the reasons why there is a disbursement-commitment gap in the practice of mitigation finance transfer. Another explanation for the disbursement-commitment gap reflected in Figure 2.2 is existing donors' rhetoric. Pledging financial commitment may help donors to promote their position as generous countries and free up deadlocks in international negotiations without the legal and financial consequences of not being able to fulfil their obligations.

Similar to the allocation of aid more broadly, whose actual allocation may deviate from the original commitment (Nunnenkamp & Thiele, 2006), the actual allocation of mitigation finance may also deviate from the original commitment, not only in terms of the absolute amount but also the parameters of its allocation. This is reflected in the estimations in Chapter 2, which show that the variables that determine mitigation finance disbursement are significantly different from the variables that determine mitigation finance commitment; the income per capita variable turns to be the only significant determinant in the actual allocation of mitigation finance provision.

With an innovative approach to building the capacity of developing countries to spend mitigation finance promptly and effectively and better time management in the international financial outflows and inflows by donors and recipients, the gap between the commitment and disbursement of mitigation finance can be narrowed. However, the gap will widen if the global climate worsens and the increase in demand for mitigation finance accelerates much faster than the supply of mitigation finance and human ability to effectively spend available financial resources in response to global climate threats.

6.2.3. Moral consequences: expected returns and aid dependency

Donors may face the moral consequences of their allocation of mitigation finance. When the benefits of foreign aid are considered global property, foreign aid may no longer be seen as a charitable endeavour but as a financial instrument for preparing the world for mitigating future environmental shocks and enhancing global environmental security Donors may have also economic interests in providing mitigation finance, although there is no evidence of this yet. When developed countries are able to offset their emission reduction at home with the reduction of emissions in overseas countries, which offers cheaper per unit of emission reduction, the donors have a greater incentive to provide mitigation finance to prepare developing countries for this offset scheme.

There might be a considerable moral challenge inherent in the choice between providing mitigation finance grants to richer developing countries that have the necessary environmental resources to ease climate change, such as vast forest areas, and providing them to poorer countries with less natural capacity. Another moral challenge is present when donors continuously provide grants for developing countries with environmental resources, i.e. forestry and natural capacity to reduce emissions, there is a danger of creating a dependency in these countries on international finance. This policy may also incentivise recipient countries to decelerate their forestry reform and governance since their declining forests and carbon storage resources are attracting foreign finance.

6.2.4. Environmental consequences: More emissions

When recipients are unable to spend mitigation finance effectively, development activities are increasing together with emission levels, therefore when mitigation finance is ineffectively spent, the large amount of mitigation finance given tends to increase the intensity of development activities that lead to a rapid increase in emissions in the short term. Examples include delaying low-carbon institutional reform and putting policies to accelerate low-carbon programmes on hold. Since there is no accurate way of calculating by how much each mitigation finance dollar will reduce emissions across developing countries in the next 5, 10, and 20 years, it is not possible to estimate how long the steady increase in emissions will continue.

Although donors use different financial instruments and start with reducing selected GHGs to avoid incentivising large polluters with mitigation finance, such as by giving loans rather than grants and focusing on CF6 and with large GWP, developing countries' increasing emission levels are unavoidable. Mitigation finance regardless its effectiveness will contribute to increased emission levels in the short term, although the effective spending will decrease emission levels in the long run.

6.2.5. Political and legal consequences: a new agreement in the new millennium?

There is an urgent need for a new legally binding climate-change agreement ratified by more of the world's countries than the number of countries which ratified the Kyoto Protocol. To support this exigency, the amount of mitigation finance will continue to increase to promote collective action and invite developing countries in mitigating their GHG emissions. The amount provided will depend on donors' responses to the negative threats of climate change, their aspirations to mitigate the risk of such threats and their financial and economic capacity. However, ODA as the source of its supply is limited, and there is a clear need to find alternative sources such as private loans and the carbon market. When the amount of mitigation finance is limited and it is administered with lack of transparency and equitable decisions about its provision and allocation, there is a limit to how far mitigation finance can support progress towards a new legally binding agreement that is more effectual, robust, and extensive than the Kyoto Protocol.

6.3. The future of mitigation finance

The provision and allocation of mitigation finance represent several donor countries' readiness to mitigate global emissions. Recipients of mitigation finance are selected on the basis of their natural capacity to contribute to the donors' aim, their development progress and performance, and whether their economic and political attributes meet the donors' interests. The expected collective returns from mitigation finance are not yet being experienced. The uneven effects of climate change across countries means that some pay less attention than others to the problems that it brings. In this new green era some developing countries have become major emission contributors and therefore their cooperation is crucial to achieving the target of mitigating global emissions. Institutional and political barriers, such as principal agent problems explained in Figure 5.2, a lack of incentive in the private sector to contribute to the supply of mitigation finance, and other institutional challenges regarding building sufficient capacity to respond to climate change problems, are hindering mitigation finance from achieving its normative objective,.

A limitation of this thesis is to evaluate the progress that has been made by mitigation finance in achieving its objective. Further research is necessary to evaluate the progress of mitigation finance in reducing emissions and its contribution to the broader aim of development aid to alleviate poverty. In addition, it is crucial to measure the extent to which mitigation finance crowds out the provision of development aid. Mitigation finance is working towards a greener Earth. However, along the way numerous international and national challenges may disrupt its provision and allocation to meet the global aim of mitigating GHG emissions. There is an enormous number of tasks that require all countries and humankind to cooperate and act together to resolve the multilevel and multidimensional challenges of climate change without compromising the importance of local and national development.

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