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Climate finance across developing countries: What are the major determinants?

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Abstract

This paper assesses the relationship between allocated amounts of public climate finance primarily aimed at mitigating climate change and the characteristics of developing countries. Two-part model and robustness checks were used to analyse 1998-2010 Rio Marker data from 180 developing countries. In both the selection and the allocation stages, the results show, developing countries tend to be selected as recipients and to receive more climate finance if they have higher CO_2 intensity, larger carbon sinks, a higher deforestation rate, lower per capita income and good governance. CO_2 emissions variable only become a significant determinant of climate finance disbursement. When climate finance is compared to overall official development assistance there are reciprocities of climate and development parameters between the two: infant mortality is still a major determinant of overall aid, and CO_2 emissions are used as a negative parameter of overall aid, potentially to avoid diverting aid from poor developing countries to more industrial developing countries. Public climate finance may crowd out development aid if its share of overall aid continues to escalate, and if there is a consistent application of emission variables and CO_2 intensity in distributing climate finance.

Keywords: Climate Finance, Developing Countries, ODA

1. Introduction

Official Development Assistance (ODA) is increasingly devoted to funding climate change mitigation in developing countries (hereafter 'climate finance') (Bierbaum and Fay 2010; OECD 2011). Much of this public funding is allocated to mitigating climate change, e.g. reducing energy consumption, rather than supporting vulnerable communities' adaptation to the negative effects of climate change (Ayers and Huq 2009). Halimanjaya and Papyrakis (2012) show that climate finance as a percentage of total development aid commitment increased almost five-fold from approximately 2% in 1998 to 9% in 2010. Little is known about climate finance specificities, yet much research has been devoted to grasping the determinants and impacts of aid more broadly (Alesina and Dollar 2000; Hoeffler and Outram 2011; Maizels and Nissanke 1984).

Policy advocacy and climate research partly account for the increase in the amount of aid provided for climate financing. OECD (2011) continuously promotes the mobilisation of ODA as fast-start climate finance. Prominent studies show different low-cost strategies for mitigating emissions in which the participation of developing countries is a vital precondition, i.e. global emission reduction via energy efficiency (Stern 2008) and via combating deforestation (Eliasch 2012). Where industrial or densely-forested developing countries are reluctant to participate due to a perceptible trade-off between emission reduction and economic growth, climate finance can be used as a catalyst to involve them in achieving global emission mitigation (Petsonk et al. 2009). As expected, policy advocacy and climate research improve the permeability of ODA, accelerating the mainstreaming of climate change into the development agenda (Klein et al. 2005), but at the risk of diverting ODA from its original objective of halving world poverty (Michaelowa and Michaelowa 2007).

The increasing amount of development aid allocated to financing climate projects and lack of information on the parameters determining its distribution call for the academic community's identification of the determinants of climate finance. So far, no research has specifically probed the specificities of climate finance determinants. Yohe (2001) explains the variables for consideration under the Mitigative Capacity Framework, namely technological options, policy instruments, institutional structure, resource distribution channels, human capital, (education and personal security), and social capital (IPCC 2001, pp. 103–104). To the author's knowledge, there is no assessment in the literature of the influence of these variables on the distribution of climate finance. Studies of environmental aid allocation, e.g. by Hicks et al. (2008) are the closest subcategorical aid assessments that address such an inquiry. Little is known about what parameters determine the distribution of climate finance, or the extent to which the characteristics of developing countries influence it.

This paper addresses this academic gap through two research inquiries. First, public climate finance is assessed in two stages; the selection stage identifies the parameters determining which developing countries are eligible to receive climate finance; and the allocation stage investigates the parameters that determine which recipients gain significantly more donor climate finance, contrasting the determinants of climate finance and overall aid across developing countries. The latter inquiry relies on two normative grounds: climate finance indirectly addresses poverty; and unlike development aid, which tackles more local and national issues, can be granted to specific countries to treat emission problems caused by other countries. One may argue that all aid includes a component of climate finance. However, one of the main interests of this study is in assessing the extent of the influence of climate variables on the allocation of development aid more broadly.

This paper directly responds to an Intergovernmental Panel on Climate Change (IPCC) inquiry evaluating donors' decisions to finance developing countries based on their capacity and responsibility for mitigating emissions (2001, pp. 107–108). As the first empirical paper addressing such an inquiry and investigating the determinants of eligibility for climate finance, this study tests new variables: carbon intensity, all of the greenhouse gases (GHG) and its combinations. It also contrasts climate finance with overall aid to discover whether there are reciprocities in the parameters between the two aid categories. These inquiries do not evaluate which sets of criteria are most cost-effective, and proposing a set of allocation criteria is beyond the scope of this paper, whose aim is only to identify the determinants of climate finance and of aid more broadly.

A seminal aid study by Maizels and Nissanke (1984) demonstrates that when donors have the freedom to pledge an amount of aid to a particular country or countries that amount is contingent upon the extent to which their beneficiaries are able to facilitate the donors' 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.

Studies of environmental aid allocation adopt a similar approach to test the parameters of environmental aid. Lewis (2003) shows that levels of democracy and economic security ties are stronger determinants than global environmental benefits and local environmental needs. He also briefly announces the difference between environmental and overall aid allocation but lacks supporting evidence, whereas Hicks et al. (2008) extend the analysis by comparing environmental and non-environmental aid (labeled 'dirty aid'). Using an alternative project-level 1990-99 aid database, they test more parameters such as ex-colonial status. Their study separately estimates bilateral and multilateral environmental aid and categorises environmental aid into 'brown aid' associated with local benefits such as access to water, and 'green aid', with global benefits. Figaj's (2010) follow-up study tests several variables, including the climate-related variables CO_2 emissions and deforestation rate, to identify the determinants of environmental aid allocation (1995-2006).

The next section explores climate finance data and hypotheses and explains the research methods. Section 3 analyses the determinants of climate finance; section 4 compares determinants of climate finance and overall aid; and section 5 summarises the findings and presents concluding remarks. While not all results are reported in the text, they are included in the appendices.

2. Empirical framework

2.1. Climate finance data

Climate finance data are obtained from the OECD Rio Marker Creditor Reporting System (CRS), which classifies ODA as related to climate change mitigation if:

> *…the activities contribute to the objective of stabilisation of GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system by promoting efforts to reduce or limit GHG emissions or to enhance GHG sequestration.* (OECD 2012a)

According to the system, activities/projects are classed as 2 (principal) if they include direct contributions to the OECD's objective climate change criteria; 1 (significant) if there are indirect contributions; or 0 (no contribution). This paper mainly analyses projects coded 2, but is non-exclusive, as climate change projects can also be additionally coded 2 or 1 for other Rio Marker categories (biodiversity and desertification) if they have multiple objectives. This study excludes non-marked/un-coded data by OECD (shown as '…') which potentially fit the criteria above due to concern that without sufficient grounds, treating these uncoded projects as zero allocation may lead to false inferences.

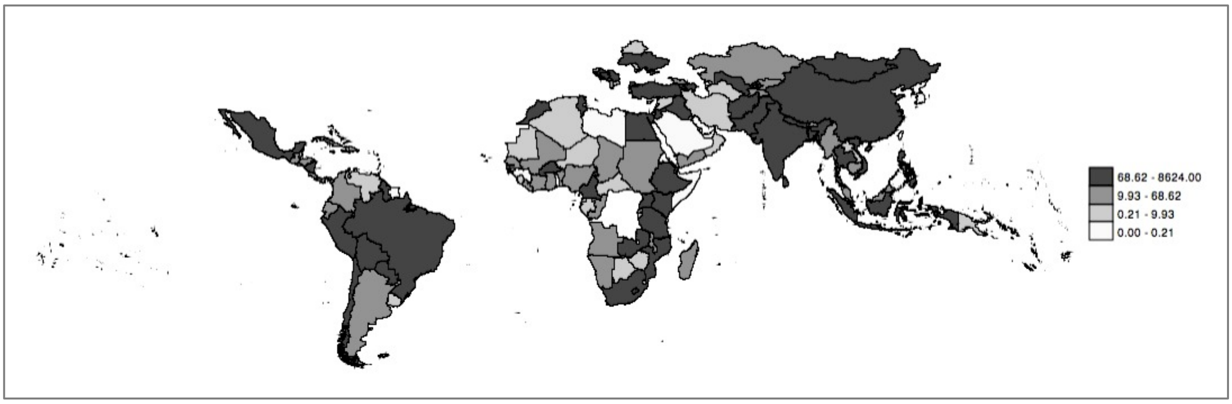
Project-level aid data in 180 developing countries (see Appendix 1) from 1998–2010 are organised into annual climate finance commitment and disbursement in US$ constant 2010. 1995 is the earliest year of coded projects in the system, but commitment and disbursement data mainly becomes available only from respectively 1998 and 2002 onwards. According to OECD (2013), aid commitment is either by grant or loan agreement, recorded at face value and signed with the recipients, whereas aid disbursement is the actual transfer of funds for the disposal of the recipient country or agency. Much attention is given to climate finance commitment that has a greater number of observations. The results of climate finance disbursement are presented if they exhibit significant differences.

Regardless of its limitations, the Rio Marker CRS data from Development Assistance Committee donors[1] used in this paper is widely accepted as the only formal tracking system under the Rio Convention. Strategies for overcoming the limitations of

[1] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Rep. Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States, EU Institutions. Other DAC donors whose data are not available (no value) are excluded.

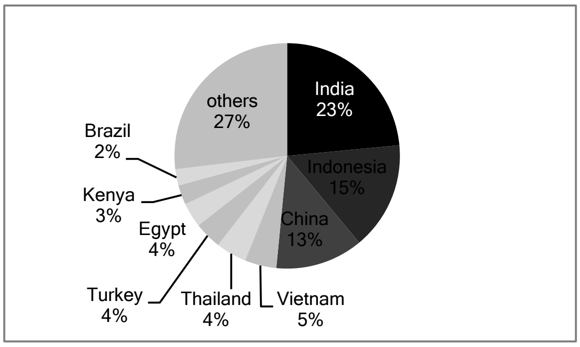
climate finance data are discussed later in the empirical framework. The data on overall aid are from OECD DAC (OECD 2012b).

The patterns of global climate finance distribution change according to the variables and categories in use. Figures 1A and 1B exhibit climate finance distribution using accumulated absolute values of climate finance commitment (1998-2010).



Data Source: (OECD 2012a)

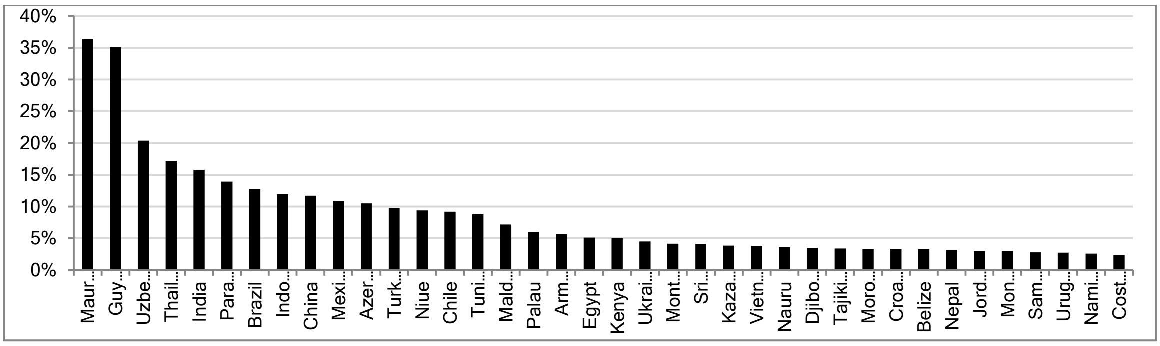
Figure 1A. The concentration of climate finance across developing countries



Data Source: (OECD 2012a)

Figure 1B. Major climate finance recipients

Both figures show that over half of climate finance goes to a small number of developing countries, notably China, Indonesia, and India. Bosetti et al. (2009) argue that early mitigation in such fast-growing countries is more economically attractive and possibly cheaper on a large scale. An unforeseen figure appears in the annual average of climate finance in overall aid commitment 1998-2010 (Figure 2): of the 148 recipients, a few receive a large share of overall donor finance for climate change projects; some, i.e. Mauritius and Guyana, receiving over 30% of aid as climate finance.



Data Source: (OECD 2012a)

Figure 2. Climate finance recipients based on the average share value of climate finance from total aid

A profound difference between climate finance and overall aid also emerges in their distribution across income groups (Table 1). Poorer countries generally receive little climate finance, although overall they are still the dominant recipients of development aid.

Table 1. The accumulated climate finance and overall aid commitment 1998-2010 across income groups

OECD's country classification based on income	Climate finance in billion US$ constant 2010	% Climate finance	Overall aid in billion US$ constant 2010	% Overall aid
Least developed countries	2.7	7.2	461.1	35.2
Other low income countries	3.7	10.0	203.6	15.5
Lower middle income countries	26.6	72.5	527.6	40.3
Upper middle income countries	3.8	10.3	113.8	8.7
More advanced developing countries	0.0	0.0	4.3	0.3
Total	36.8	100	1310.4	100

Data Source: (OECD 2012a, 2012b)

2.2. Estimators

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

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

Other variables are included as controls (Z_{it}) (Table 3 and Appendix 2) and unobservable factors are captured by residuals (ε_{it}). Climate finance and overall ODA are measured in US$ constant 2010 rather than per capita, and population is included as a control variable. All variables with real values are measured in logarithms. Time dummies are included but not presented. The hypothesis for each parameter is explained in a later section.

To estimate these parameters this research employs the two-part model, which consists of two estimation stages accommodating the assumption; that is, a developing country at period t is going through two stages of assessment in order to receive climate finance. The selection stage uses the general logit model (hereafter 'logit') to identify the parameters used to select developing countries to receive climate finance. The allocation stage investigates the parameters used to decide which recipients receive more climate finance. This latter stage employs the Operating Least Square (OLS) regression model, strictly, to positive climate finance received at time-t ($A_{it}^{j} > 0$), dropping non-climate finance and aid recipients at this stage. For comparison, A_{it}^{j} is contingent upon the same set of independent variables in both stages.

The two-part model is selected from all possible estimators to control bias from censored climate finance data, due to inexplicit features of the data-gathering mechanisms leading to the censoring point remains unknown. The data may be incidentally censored and this censoring point depends on the interpretation of individual donors or responsible parties, who possibly have lacks of understanding of recently developed coding guidelines. This possibly can be also interpreted as a violation of coding rules (see Michaelowa and Michaelowa 2011).

When the dependent variable is censored, using the OLS shifts the intercept up and down while the slope coefficient remains the same, as the mean of censored aid data is possibly lower than that of non-censored data. So the sample mean of censored data cannot be used to estimate the mean of original population without adjustment (Cameron and Trivedi 2005, p. 530). Tobit Type I is excluded as the censoring point of climate finance data is unknown. The Heckman Selection Model (HSM) (Tobit Model Type II) does not allow both selection and allocation stages to be estimated using an identical set of variables. The Hausman test allows estimations with both fixed and random effects, but the conditional logit model (CLM), introduced by McFadden (1973), has an *incidental parameter problem* (Baltagi 2005, p. 212-3) due to large samples, 180 developing countries, and a short data period. The CLM automatically includes fixed effects but is restricted to testing time invariant variables (Michaelowa and Michaelowa 2011).

To some extent, under- and over-reporting of climate finance data are inherent distortions of the beta estimators' accurate representation of the extent of each relationship, and so the beta parameters should only be treated as proximities. The first robustness check includes dummy variables, namely all regions (except the Caribbean), countries classified as Reducing Emissions from Deforestation and Forest Degradation (REDD+) potential sites, and coalitions. The second robustness check employs the HSM to anticipate a potential bias when estimations do not fulfil the assumption of the two-part model, and to examine the consistency and significance of the main variables.

The assumption of the two-part model is that Rho (ρ) − indicating the degree of independence of residuals from the two stages − equals zero. In other words, the residuals in both stages should be uncorrelated. The tests for assumptions find that the residuals between the two stages of the main estimations of climate finance indicate a degree of correlation, violating the assumption of the two-part model. For climate finance commitment and disbursement, P-values of chi2(1)==0, indicating the correlation between error terms between two-stage estimations, are highly significant at (0.003) and (0.021) with chi(2)=8.59 and 5.34 respectively. The HSM thus becomes an alternative estimator, allowing correlation of error terms between the two stages.

There is strong evidence that all the residual errors are not normally distributed and homoscedastic. The p-values of the skewness and Breusch-Pagan tests are below 0.01, indicating that strong rejections of the null hypotheses that residuals from all estimations are normally distributed and homoscedastic. However, neither normality nor homoscedascity are necessary conditions for consistent beta parameters in the two-part model (Cameron and Trivedi 2005, pp. 534-538).

Table 2. Diagnostics of Normality and Homoscedasticity

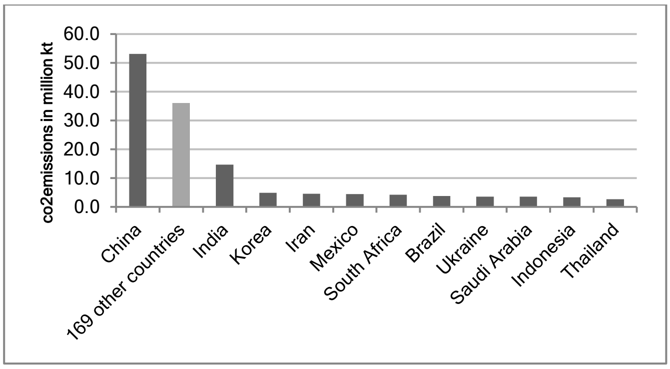
Dependent variable (Commitment)	**Normality (Skewness test)**	**Homoscedasticity (Breusch-Pagan/ Cook-Weisberg test)**	**(ρ) Chi2(1)**
Commitment			
Log of climate finance	18.61 (0.000)	39.56 (0.000)	8.59 (0.003)
Log of overall aid	35.54 (0.000)	13.07 (0.001)	0.96 (0.328)
Disbursement			
Log of climate finance	15.91 (0.000)	46.97 (0.000)	5.34 (0.021)
Log of overall aid	33.93 (0.000)	40.77 (0.000)	0.15 (0.698)

2.3. 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 with technologies that are more energy-efficient, some scholars suggest a possible cheap option to improve energy efficiency such as replacing old technologies in developing countries (Berkeley et al. 1998, p. 395). Often these countries, especially those producing large emissions (Figure 3) argue that they have insufficient technical knowledge for this (Den Elzen and Höhne, 2008). Petsonk et al.

(2009) respond that climate finance can be used as a provisional participatory catalyst, e.g. to improve energy efficiency. These arguments lead to two hypotheses representing the responsibility of developing countries. The first is related to the magnitude of emissions; the latter represents the increased inefficiency of emissions generated from economic activities:

Hypothesis#1A: The larger the emissions of developing countries, the greater the likelihood that they are selected as climate finance recipients and receive more climate finance.
Hypothesis#1B: The greater the increasing trend of CO_2 intensity in developing countries, the greater the likelihood that they are selected as climate finance recipients and receive more climate finance.



Data Source: (WDI, 2013)

Figure 3. Accumulated CO_2 emissions (1998-2008)

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) which are selected due to have a greater number of observations.

The increase in CO_2 intensity is measured by the ratio of carbon intensity from each developing country in two subsequent periods (*rci*), as in Eq. 2:

$$rci = \frac{CO2/GDP_t}{CO2/GDP_{t-1}} \qquad (2)$$

The *rci* captures the variation of carbon emissions in comparison to the extent of economic activity over a time period; *rci>1* indicates increasing emissions produced per unit of economic activity over 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 paper does not allocate any weight. Instead, it separately tests developing countries' responsibility (emissions) and capacity (carbon sinks). Ideally, *rci* is added to Eq. 1 and GHG in CO_2e replaces *lnco2*. However, these approaches significantly reduce the number of samples (see Table 3), 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 overall aid.

The third variable, carbon sinks, represents the size of natural reservoirs 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 one low-cost and effective method of reducing global emissions (Canadell and Raupach 2008). It preserves a large amount of GHG inventory, which has the potential to mitigate atmospheric carbon emissions (Bosetti et al. 2009; Sasaki and Yoshimoto 2010). This study also includes deforestation rate as tested by Figaj (2010). The following hypotheses represent developing countries' mitigation capacity:

Hypothesis#2A: The larger the carbon sinks of developing countries the greater the likelihood that they are selected selection as climate finance recipients and receive more climate finance.

Hypothesis#2B: The higher deforestation rate of developing countries, the greater the likelihood that they are selected as climate finance recipients and receive more climate finance.

Marine Protected Areas (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; Wickramasinghe et al. 2009) show that per unit area, these reservoirs make a bigger contribution to long-term carbon sequestration than terrestrial forest. Climate finance investment in MPAs may primarily aim to protect biodiversity, with possible long-term reduction of carbon emissions. This study separately tests the percentage of MPAs in total territorial waters from WDI (2013) as an additional proxy of carbon sinks, labelled '*marine*'.

Ideally, idle sinks with potential for conversion, such as tropical wetlands, are also included in the specification. Due to much uncertainty about land tenure rights they are excluded from the main specification. This study acknowledges Emerson et al.'s (2012) Environmental Performance Index (EPI) data. However, this index is not included in the specification since climate change aspects of EPI are covered by the emissions, CO_2 intensity, carbon sinks, and deforestation variables.

Hypothesis#3: The better the governance of developing countries, the greater the likelihood that they are selected as climate finance recipients and receive more climate finance.

The governance variable is part of the specification, since it is assumed that donors take into account aid studies which suggest that aid is more effective in a good policy environment (Dollar and Levin 2006; Epstein and Gang 2009). Although no such investigation has been made specifically concerning climate finance, developing countries without good governance may have difficulties fulfilling the accountability and legal requirements for receiving climate finance. Without good governance, the national executing body may find it difficult to comply with expensive and administrative monitoring, reporting, and verification (MRV) systems (Bierbaum and Fay 2010). The absence of proper land tenure rights, such as in Africa (Unruh 2008), becomes a major obstacle of carbon sequestration projects. To measure governance, the averages of all six Worldwide Governance Indicators (WGI) (Kaufmann et al. 2010) are taken as a proxy. All six are equally important in supporting the implementation of climate change projects, i.e. mitigating deforestation with low regulatory quality and poor corruption control can be risky and ineffective.

Hypothesis#4: The lower income per capita of developing countries, the greater the likelihood that they are selected as climate finance recipients and receive more climate finance.

Income (GDP) per capita (WDI 2013) is included, to test whether climate finance, as part of development aid, also carries a development mission, i.e. is distributed to enhance economic growth and halve poverty. The scope of income per capita to measure other development aspects is limited, therefore infant mortality is included in the main specification. The poverty gap index is also taken into a consideration to capture other aspects of development, but its limited coverage significantly reduces the number of samples. So, income per capita and infant mortality are chosen as the best possible compromise. The high correlation between these two measurements (Appendix 3) is thoroughly considered, and robustness checks are used to test the stability of parameters. In the case of overall aid, infant mortality was expected to be positive and significant.

Several control variables are added into Eq. (1), namely Foreign Direct Investment (FDI) inflow, level of democracy, population size, and historical and political ties. These variables are expected to have positive relationships with climate finance. Donors may favour providing climate finance to protect their existing foreign investments (Buchner et al. 2011, p.12). Democratic countries that exhibit a stronger commitment to the international environment (Neumayer 2002) may show greater interest in being involved in reciprocal multilateral environmental action and hosting climate change mitigation projects. The interest lies in whether climate 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 one indicating that countries with smaller populations receive a more aid. The potential multicollinearity between population and CO_2 emissions is kept in mind (Appendix 3). Lastly, aid studies such as Burnside and Dollar's (1997) show that donors tend to give development aid to their ex-colonies. The studies on environmental aid allocation found a similar pattern; ex-colonies tend to receive more environmental aid (Hicks et al. 2008). This research investigates whether this is also the case in climate finance allocation. All tested variables are summarised in Table 3 and in the data sources in Appendix 2.

Table 3. Summary and descriptive statistics of dependent and independent variables

Variable	Label	Observation	Mean	Std. Dev.	Min	Max
Dependent variable: Aid (1998-2010)						
Commitment	$\log A^c$	1034	13.744	2.915	3.059	21.711
	$\log A^T$	2009	19.202	1.682	10.597	23.863
Disbursement	$\log A^c$	1002	13.356	2.494	6.016	20.715
	$\log A^T$	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	2244	109.352	61.822	1.000	232.000
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+ potential	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. Developing countries' characteristics and climate finance

This section presents the results of the inquiry into the two stages of commitment to climate finance and compares them with actual disbursement. At the selection stage some variables consistently determine the allocation of climate finance, but at the allocation stage few determinants only affect climate finance disbursement.

Six parameters significantly determine climate finance commitment at the selection stage (Table 4 column 1 (c1)). Carbon sinks (*lnforest*), deforestation (*deforest*), governance (*govern*), population (*lnpop*), and democracy (*democracy*) are statistically significant at 1%, and income per capita (*lngdppc*) at 5%. The robustness checks (c2) show that these parameters remain stable and significant apart from (*democracy*), which is statistically insignificant. At the allocation stage (c3), the five consistent determinants also determine how much climate finance commitment is allocated; FDI inflow is a significant determinant here. The discussion below considers each of these parameters.

The size of existing carbon sinks and the rate of forest loss are significant determinants of climate finance. In the selection stage, the coefficient of *lnforest* (0.267) (indicating that if forest area rises by 10% so *lnforest* rises by 0.10 and the log odds rise by 0.10x0.267=0.026), implies that the odds of being selected as a climate finance recipient rise by ($e^{0.026}$)=1.026, or 2.6%. Whereas, the beta parameter of *deforest* (0.562) is similarly positive and significant indicating that the increasing rate of deforestation is also a concern for donors seeking to invest climate finance in developing countries. These positive relationships show that the odds increase with the expansion of carbon sinks and increasing deforestation. However, expanding carbon sinks, i.e. forest areas, involves economic trade-offs such as giving up agricultural land for protected forest areas. In the allocation stage these two determinants also positively affect the amount of climate finance that donors pledge.

Good governance is another influential parameter of climate finance. In both stages (c1 and c3), governance is a strong significantly positive determinant at 1%. Although Hicks et al. (2008, pp. 112–114) only find this parameter positive and significant at 5% at the selection stage for bilateral and multilateral green and brown environmental aid. Unlike a proxy used in this research, they only test 'government effectiveness' to represent governance rather than taking the average of six indicators. The odds ratio of *govern* is 2.01 ($e^{0.698}$), indicating that with an average positive governance index of 1, a developing country has 2.01 times higher odds of eligibility for climate finance commitment compared to one with an index of 0. Improving overall governance performance index by one unit tends to increase the amount of climate finance commitment by 111.3%.

Table 4. Selection and allocation stages of climate finance commitment and disbursement

	Commitment				Disbursement			
	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	0.081	0.137	0.081	0.120	-0.100	0.005	0.241**	0.362***
	(0.842)	(1.074)	(0.632)	(0.809)	(-0.994)	(0.038)	(1.969)	(2.619)
lnforest	0.267***	0.231***	0.153**	0.253***	0.370***	0.410***	0.140***	0.181***
	(6.210)	(4.033)	(2.231)	(3.076)	(7.860)	(6.185)	(2.630)	(2.802)
deforest	0.562***	0.679***	0.556***	0.542***	0.804***	0.954***	0.578***	0.569***
	(3.901)	(4.444)	(2.696)	(2.589)	(5.223)	(5.538)	(3.666)	(3.649)
govern	0.698***	1.113***	1.158***	0.772**	0.804***	1.194***	1.048***	0.839***
	(3.319)	(4.354)	(4.219)	(2.450)	(3.667)	(4.471)	(4.714)	(3.603)
lngdppc	-0.396**	-0.563***	-0.506**	-0.242	-0.153	-0.295	-0.745***	-0.685***
	(-2.545)	(-2.718)	(-2.556)	(-1.039)	(-0.999)	(-1.381)	(-4.160)	(-3.329)
lninfant	0.135	0.589***	-0.198	0.090	0.338*	0.845***	-0.377**	0.029
	(0.728)	(2.824)	(-0.863)	(0.317)	(1.819)	(3.868)	(-1.973)	(0.134)
lnpop	0.369***	0.302*	0.638***	0.505***	0.500***	0.347**	0.441***	0.176
	(3.030)	(1.877)	(4.069)	(2.840)	(4.000)	(2.092)	(2.863)	(1.051)
fdiinflow	0.023	0.031	0.057***	0.061***	0.020	0.029	0.016	0.035*
	(1.137)	(1.462)	(3.377)	(3.600)	(1.198)	(1.630)	(0.868)	(1.693)
democracy	0.054***	0.025	0.002	0.023	0.044***	0.020	0.023	0.034**
	(3.732)	(1.468)	(0.100)	(0.996)	(3.043)	(1.124)	(1.421)	(2.028)
xcolony	-0.119	0.125	-0.033	-0.265	-0.089	-0.129	0.026	0.112
	(-0.699)	(0.521)	(-0.143)	(-0.960)	(-0.508)	(-0.509)	(0.135)	(0.471)
eastsouthafrica		-2.149***		0.535		-1.349**		-0.494
		(-3.590)		(0.693)		(-2.164)		(-0.829)
westafrica		-2.889***		0.051		-2.157***		-1.538**
		(-4.734)		(0.064)		(-3.449)		(-2.414)
eastasiapacific		-1.268**		0.695		-0.826		0.012
		(-2.384)		(1.033)		(-1.443)		(0.026)
southasia		-0.747		1.135		0.700		0.846
		(-1.054)		(1.406)		(0.973)		(1.478)
easteurope		-1.366**		0.745		-0.799		-0.473
		(-2.111)		(0.905)		(-1.178)		(-0.776)
westeurope		-2.652***		2.520**		-1.148		1.815**
		(-3.479)		(2.318)		(-1.431)		(2.303)
middleeast		-1.710***		-0.022		-0.717		-1.484**
		(-2.675)		(-0.027)		(-1.049)		(-2.181)
northafrica		-0.839		2.920***		1.054		1.162*
		(-1.276)		(3.396)		(1.489)		(1.714)
latinamerica		-0.551		-0.243		-0.461		-0.580
		(-0.868)		(-0.322)		(-0.660)		(-1.065)
reddplus		0.530**		0.388		0.900***		0.295
		(2.336)		(1.534)		(3.636)		(1.355)
smallisland		0.070		0.583		0.866*		0.168
		(0.178)		(1.195)		(1.952)		(0.372)
opecmember		-0.651**		-1.708***		-1.011***		-1.191***
		(-1.983)		(-4.211)		(-2.889)		(-3.219)
χ^2	278.8	307.2			299.5	336.4		
R^2			0.266	0.331			0.348	0.445
Adjusted R^2			0.244	0.299			0.328	0.416
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 t-statistics in parentheses. *, ** and *** denote significance at the 10%; 5% and 1% level respectively.

Conversely, *lngdppc* exhibits a negative relationship with climate finance in both stages, *ceteris paribus.* Developing countries with lower income per capita appear to be eligible for and to invite donors' commitment to invest climate finance in them. When GDP per capita decreases by 1%, climate finance pledges rise by about 0.5% – significant at 1%, *ceteris paribus*. According to Hicks et al. (2008), poorer recipients tend to attract more green aid commitment from bilateral donors. In the selection stage these authors also report a negative relationship between income per capita and environmental aid, including green aid. Lewis (2003) shows that US environmental aid is targeted at lower-income countries with a significant negative coefficient of GNI per capita, whereas Figaj (2010) finds no evidence that Japan, GEF and the World Bank use income per capita as a salient characteristic to choose which developing countries are eligible for environmental aid. This shows that climate 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 check the stability of main parameters due to potential multicollinearity between *lninfant* and *lngdppc*, they are tested in turn. The results (available upon request) show that other parameters are consistently significant and stable. This research includes both parameters in the main specification to capture multiple aspects of development.

Two control variables at the selection stage – *lnpop* and *democracy* – influence the probability of a developing country being eligible for climate finance commitment, both significant at 1% (c1). Larger developing countries may have a higher chance of not only being eligible but also receiving more climate finance commitment. A small-country bias is identified at both stages. 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 climate finance than those in large developing countries. Hicks et al. (2008) find a similar pattern for brown and green aid at both stages. For *democracy*, the result of the main estimation in column 1 agrees with Lewis' (2003) findings on US, GEF, and Private Foundation environmental aid and Hicks et al.'s (2008) finding that democracy is a positive determinant of bilateral green aid. However, it is less significant in the robustness check (c2), indicating that democratic environment may be a favourable determinant but is not as strong as carbon sinks, deforestation, governance, and income per capita.

At the allocation stage (c3), *democracy* is insignificant and FDI inflow is more valuable from the donors' vantage point; *fdiinflow* is a positive and significant determinant and consistently robust (c4). Recipients with higher FDI inflow incentivise donors to pledge a greater amounts of climate finance investment, perhaps because climate finance can indirectly support and protect the investments of donor-country companies; e.g. wind turbine and light bulb manufacturers continue their operations and have a larger operational landscape in the recipient countries.

One of the main parameters, *lnco2,* is insignificant at both stages. It exhibits a consistent positive sign in the case of climate finance commitment; there is no evidence that it determines such commitments. Donors may use climate finance as an incentive to invite developing countries with greater capacity (larger *lnforest*) to join in global emission reduction, rather than rewarding them with greater responsibility (higher *lnco2*). The variable of historical ties *xcolony* is also insignificant at both stages, although Hicks et al. (2008) find it significant for bilateral and multilateral green aid. It is possible that using climate finance for political reasons is restricted by the narrower objectives of climate finance. Although some variables are insignificant, the Wald test shows that including them improves the fit of the model; the chi-squared value of joint significance is higher (182.50) than when including only significant parameters (141.40).

An important difference between commitment and disbursement is that *lnco2* becomes significant and negative in the selection stage for disbursement. In the allocation stage of climate finance disbursement (c7), *lnco2* is positive and significant at 5% and consistently robustness (c8) at 1%. Previously, *lnco2* was insignificant, but it becomes significant determinant of climate finance disbursement. Donors seem to delay using this variable in decision-making about allocation until the actual aid transfer stage, perhaps intentionally, to avoid giving an early impression that industrial developing countries with better economies are more entitled to climate finance than poorer and non-industrial ones.

Recently GEF (2011) announced that using the 2005 GEF Global Benefit Index for climate change (GBIcc) (calculated as (carbon intensity_{1990}/carbon intensity_{2000})*baseline GHG) as a determinant of environmental aid would divert more aid from poorer to relatively richer developing countries. Although it is possible to delay using the emission variable, e.g. by selecting developing countries with fewer emissions (negative *lnco2* in c5), the diversion is unavoidable and more climate finance is invested in richer and more industrial countries (positive *lnco2* in c7 and c8). However, when the coefficients from the two-part model are compared with those from the HSM, the coefficient of *lnco2* with disbursement data is no longer significant, although the main parameters remain robust and consistent except for the control variable population (*lnpop*), which is insignificant in the selection stage (Appendix 4, c27).

Table 5 shows the estimation results using other proxies of emissions and carbon sinks. Some estimation results suffer from the limited number of observations, but are nevertheless included for comparison.

Table 5. Estimations of climate finance commitment using alternative proxies of emissions

	Selection						Allocation					
	GHGs[+]	CH_4	N_2O	HFCs	PFCs	SF_6	GHGs[+]	CH_4	N_2O	HFCs	PFCs	SF_6
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
lnco2		-0.557	-0.831**	-2.507**	-1.666	-3.090		0.030	-0.632	-1.017	-28.095*	-11.551**
		(-1.601)	(-2.575)	(-2.431)	(-0.744)	(-1.261)		(0.052)	(-1.134)	(-1.043)	(-3.237)	(-2.607)
lnforest	0.728***	0.569***	0.562***	0.038	0.465	1.632***	0.156	0.365	0.094	-0.224	-21.086*	-1.544
	(4.298)	(2.777)	(3.528)	(0.126)	(0.787)	(2.712)	(0.476)	(1.164)	(0.329)	(-0.507)	(-3.304)	(-1.413)
deforest	0.218	-0.072	-0.054	-0.523	0.006	-2.263	0.294	0.014	0.119	-0.444	-71.865*	-10.732*
	(0.608)	(-0.208)	(-0.158)	(-0.686)	(0.002)	(-1.085)	(0.393)	(0.019)	(0.166)	(-0.258)	(-3.612)	(-2.098)
govern	1.804***	1.855***	1.639***	0.809	1.213	4.406***	0.353	0.160	0.455	1.295	-74.105*	6.639
	(2.641)	(2.928)	(2.581)	(0.666)	(0.656)	(2.609)	(0.284)	(0.145)	(0.395)	(0.849)	(-2.986)	(1.479)
lngdppc	-0.275	-0.167	0.023	-0.443	0.925	-1.027	0.524	0.701	0.716	0.142	50.161*	0.713
	(-0.695)	(-0.468)	(0.064)	(-0.767)	(0.985)	(-1.076)	(0.875)	(1.297)	(1.257)	(0.158)	(3.103)	(0.258)
lnghgcom	-0.532						-0.305					
	(-1.475)						(-0.655)					
lnch4		-0.347						-1.401*				
		(-1.010)						(-1.716)				
lnn2o			-0.376*						-0.096			
			(-1.779)						(-0.411)			
lnhfcs				0.746***						0.590**		
				(2.696)						(2.180)		
lnpfcs					-0.502						-3.699*	
					(-0.963)						(-4.097)	
lnsf6						0.481*						-1.109
						(1.804)						(-1.542)
χ^2	49.2	53.8	60.8	35.0	26.1	34.9						
R^2							0.280	0.323	0.297	0.585	0.979	0.742
Adjusted R^2							0.052	0.105	0.071	0.308	0.770	0.346
P-values	0.000	0.000	0.000	0.020	0.163	0.021	0.002	0.000	0.001	0.000	0.770	0.346
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.

Of the six GHGs, the coefficients of *lnhfcs* are positive and significant at both stages at 1% and 5% at selection and allocation respectively (c12 and c18), whereas the coefficients of *lnn2o* and *lnsf6* are significant only at the selection stage at 10% (c11 and c14). 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,* and *lnn2o* including *lnco2,* have a negative relationship with climate finance, potentially due to their high correlations – above 0.7 – with *lnco2,* whereas *lnhfcs* and *lnsf6* have lower correlations with *lnco2* (See Appendix 3).

rci, indicating increasing CO_2 intensity, appears to be positive and significant at 1% (Table 6), showing that the more emissions per unit of GDP compared to the previous year, the higher the probability of a developing country being eligible for climate finance commitment and the more climate finance commitment the recipients gain. This unexpected finding shows that increasing intensity of emissions of developing countries positively determines the distribution of climate finance in both the selection and the allocation stage.

A further consideration is necessary, as using *rci* and other emissions with high GWP may have detrimental effects. This research 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 climate finance. It also potentially excludes poorer and non-industrial countries from mitigating climate change (Ballesteros et al. 2010, p.273,288).

As an additional proxy of carbon sinks, *marine* is positive and only significant at 1% in the selection stage (Table 6, c23). Developing countries with larger MPAs tend to be eligible for climate 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). In column 23, comparing the odds ratio of *lnforest* ($e^{0.220}$=1.25) to *marine* ($e^{0.025}$=1.02) shows that a developing country with MPAs is considered eligible for climate finance but the odds ratio is far less than for a developing country with forest areas, *ceteris paribus*.

Overall, developing countries' responsibility for reducing emissions and their capacity to do so determine the global distribution of climate finance. There are several measurements for emissions, and early indications are that the emissions variable is used strategically as a determinant only in the real transfers of climate finance.

Table 6. Estimations of climate finance commitment for CO_2 intensity and an additional proxy of carbon sinks

	rci		marine	
	Selection	Allocation	Selection	Allocation
	(21)	(22)	(23)	(24)
lnco2	-0.037	0.056	-0.253*	-0.074
	(-0.223)	(0.265)	(-1.732)	(-0.402)
lnforest	0.220***	0.002	0.202***	0.052
	(3.333)	(0.016)	(4.271)	(0.660)
deforest	0.606***	0.573**	0.744***	0.572**
	(2.778)	(2.184)	(4.318)	(2.444)
govern	0.511	0.804*	0.400	0.959***
	(1.436)	(1.869)	(1.609)	(3.142)
lngdppc	-0.226	-0.312	-0.273	-0.389
	(-0.970)	(-1.208)	(-1.316)	(-1.515)
lninfant	0.147	-0.035	-0.141	-0.365
	(0.540)	(-0.129)	(-0.642)	(-1.423)
lnpop	0.523**	0.932***	0.808***	0.950***
	(2.350)	(3.533)	(4.402)	(3.983)
fdiinflow	0.008	0.106***	0.016	0.067***
	(0.309)	(2.620)	(0.622)	(3.143)
democracy	0.071***	0.054*	0.061***	0.019
	(3.021)	(1.770)	(3.414)	(0.784)
xcolony	0.063	0.296	-0.066	0.199
	(0.239)	(1.079)	(-0.320)	(0.732)
rci	0.395***	0.229**		
	(3.297)	(2.534)		
marine			0.025***	0.011
			(3.004)	(1.355)
χ^2	161.7		213.3	
R^2		0.360		0.303
Adjusted R^2		0.323		0.274
P-values	0.000	0.000	0.000	0.000
N	567	366	865	503

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

4. Climate finance vs. overall aid

This section contrasts the distribution of climate and overall aid in two stages. At the selection stage three determinants affect the distribution of climate finance and overall aid differently and two have similar influences on both categories. The discussion begins with the differences.

First, the relationship of overall aid and *lnco2* is negative and significant at 1% (Table 7, c25). Emission levels tend to be a counter-parameter of overall aid, indicating that aid more broadly is intentionally designated to developing countries with lower emission levels, which are often characterised as poorer and non-industrial, and that the increasing share of climate finance has not diverted the main objectives of aid more broadly. The emissions variable is possibly used as a counter-parameter, to minimise the risk of the diversion of overall development aid from poorer to industrial and richer developing countries.

Secondly, *lnforest* is insignificant in determining the distribution of overall aid. There is no evidence of deliberately using development aid to support more development activities in densely-forested developing countries.

Third, the relationship between infant mortality (*lninfant*) and overall aid is positive and significant at 1%, indicating that poverty and social development are still major determinants of overall aid allocation. Its coefficient 5.576 (Table 7, c25) indicates that if infant mortality rises by 10% (so *lninfant* rises by 0.10), the log odds rise by 0.10x5.576=0.558, implying that the odds of being selected as an overall aid recipient rise by ($e^{0.558}$)=1.747 or 74.7%.

The insignificance of infant mortality (*lninfant*) in the case of climate finance is possibly due to a weak relationship between climate change projects and social development. While there is often competition between climate projects and development for natural resources, such as between land ownership and local communities' access to resources (Larson 2011), there is limited information to explains how, for example, reforestation projects may reduce infant mortality.

A few determinants affect climate finance and overall aid provisions differently, but governance and population determine both in a similar manner. First, the coefficients of *govern* are consistently significant at 1% in both climate finance and overall aid (compare Table 7, c25 and Table 4, c1). Although *govern* is positive and significant in both categories, it is a stricter gatekeeper of eligibility criteria than in the case of overall aid.

Surprisingly, in general qualifying for aid demands better governance than qualifying for climate finance. In climate finance, governance may be secondary to climate-related parameters.

Table 7. Selection and allocation stages of overall aid commitment

	Selection (25)	Allocation (26)
lnco2	-3.946***	-0.021
	(-6.062)	(-0.720)
lnforest	0.160	0.013
	(1.006)	(0.762)
deforest	-0.584	0.048
	(-1.246)	(1.013)
govern	2.668***	0.441***
	(3.231)	(6.143)
lngdppc	-0.179	-0.507***
	(-0.335)	(-10.590)
lninfant	5.576***	0.017
	(6.394)	(0.308)
lnpop	3.099***	0.529***
	(5.199)	(14.491)
fdiinflow	-0.002	0.017***
	(-0.057)	(3.166)
democracy	-0.134***	0.017***
	(-2.615)	(3.132)
xcolony	-1.212***	0.162***
	(-3.093)	(2.681)
χ^2	108.3	
R^2		0.616
Adjusted R^2		0.609
P-values	0.000	0.000
N	1146	1059

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

Infant mortality is a stronger determinant of overall aid than of climate finance. Although, infant mortality is only significant at the selection stage of overall aid, its beta parameter in the case of overall aid is higher than in any model at selection stage of climate finance (Table 4, c2, c5, c6). This evidence indicates that more generally, development aid is still targeted to developing countries with more social development problems, which seem to be less important determinants in the distribution of climate finance.

Historical and political aspects such as ex-colonial status appear to play a more important role in the allocation of wider aid, being significant at 1%, although with contradictory relationship signs (Table 7, c26 and c27). It is negative at the selection stage but positive at the allocation stage. Aid tends to be assigned to developing countries without political ties, although this status has a positive effect on recipients.

Governance, income per capita, population and FDI inflow (compare Table 4, c3 with Table 7, c26) determine the allocation of both categories of aid similarly. Good governance is consistently used as an assurance mechanism at the allocation stage. There is a consistent significantly negative relationship with income per capita and a significantly positive relationship with population in both 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 there is strong evidence of a small-country bias – the coefficient of *lnpop* is less than 1 – showing that in terms of aid per capita, countries with smaller populations tend to receive more climate finance and overall aid commitment. Lastly, FDI inflow is a positive determinant for both categories, showing that regardless of the aid category, an open economy is an attractive characteristic with the possibility of aid generating economic co-benefits such as conditional aid spending on procurements to be made from specified donor-country companies.

5. Conclusion

As the first study to assess the determinants of developing countries' eligibility for climate finance, this paper shows that in the selection and allocation stages the quantity of emissions, higher CO_2 intensity, carbon sink capacity, good governance, income per capita and population size determine which countries receive such aid. FDI, *ceteris paribus*, appears to be a strong determinant of climate finance at the allocation stage. The emission variable is significant only in the actual disbursement of climate finance, and not when donors pledge their commitments.

An equally important finding is the reciprocities between climate and development parameters. Poorer countries tend to be selected and to receive more commitment to giving climate finance, and the emission variable is used as a negative parameter to overall aid, conceivably to avoid the diversion of development aid from poorer developing countries. This diversion is an inherent risk if the share of climate finance in overall aid continues to escalate, and there is consistent application of the emissions variable as a determinant of climate finance.

Extensions to this paper include an analysis of the variability of climate finance determinants in different Kyoto Protocol periods and an assessment of climate finance determinants from individual donors. The assessment of adaptation aid across developing countries, regardless of amount, has also become increasingly relevant to assess donors' allocation performance in addressing the impact of global climate change on vulnerable countries and territories.

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APPENDICES

APPENDIX 1: LIST OF DEVELOPING COUNTRIES

No.	Country	Code	No.	Country	Code	No.	Country	Code
1	Afghanistan	AFG	34	China	CHN	67	Guyana	GUY
2	Albania	ALB	35	Chinese Taipei	TWN	68	Haiti	HTI
3	Algeria	DZA	36	Colombia	COL	69	Honduras	HND
4	Angola	AGO	37	Comoros	COM	70	Hong Kong	HKG
5	Anguilla	AIA	38	Congo, Dem. Rep.	ZAR	71	India	IND
6	Antigua and Barbuda	ATG	39	Congo, Rep.	COG	72	Indonesia	IDN
7	Argentina	ARG	40	Cook Islands	COK	73	Iran	IRN
8	Armenia	ARM	41	Costa Rica	CRI	74	Iraq	IRQ
9	Aruba	ABW	42	Cote d'Ivoire	CIV	75	Israel	ISR
10	Azerbaijan	AZE	43	Croatia	HRV	76	Jamaica	JAM
11	Bahamas, The	BHS	44	Cuba	CUB	77	Jordan	JOR
12	Bahrain	BHR	45	Cyprus	CYP	78	Kazakhstan	KAZ
13	Bangladesh	BGD	46	Djibouti	DJI	79	Kenya	KEN
14	Barbados	BRB	47	Dominica	DMA	80	Kiribati	KIR
15	Belarus	BLR	48	Dominican Republic	DOM	81	Korea	KOR
16	Belize	BLZ	49	Ecuador	ECU	82	Korea, Dem. Rep.	PRK
17	Benin	BEN	50	Egypt	EGY	83	Kosovo	KSV
18	Bermuda	BMU	51	El Salvador	SLV	84	Kuwait	KWT
19	Bhutan	BTN	52	Equatorial Guinea	GNQ	85	Kyrgyz Republic	KGZ
20	Bolivia	BOL	53	Eritrea	ERI	86	Lao PDR	LAO
21	Bosnia-Herzegovina	BIH	54	Ethiopia	ETH	87	Lebanon	LBN
22	Botswana	BWA	55	Falkland Islands (Malvinas)	FLK	88	Lesotho	LSO
23	Brazil	BRA	56	Fiji	FJI	89	Liberia	LBR
24	Brunei Darussalam	BRN	57	French Polynesia	PYF	90	Libya	LBY
25	Burkina Faso	BFA	58	Gabon	GAB	91	Macao	MAC
26	Burundi	BDI	59	Gambia	GMB	92	Macedonia, FYR	MKD
27	Cambodia	KHM	60	Georgia	GEO	93	Madagascar	MDG
28	Cameroon	CMR	61	Ghana	GHA	94	Malawi	MWI
29	Cape Verde	CPV	62	Gibraltar	GIB	95	Malaysia	MYS
30	Cayman Islands	CYM	63	Grenada	GRD	96	Maldives	MDV
31	Central African Rep.	CAF	64	Guatemala	GTM	97	Mali	MLI
32	Chad	TCD	65	Guinea	GIN	98	Malta	MLT
33	Chile	CHL	66	Guinea-Bissau	GNB	99	Marshall Islands	MHL

No.	Country	Code	No.	Country	Code	No.	Country	Code
100	Mauritania	MRT	133	Sao Tome & Principe	STP	166	Tuvalu	TUV
101	Mauritius	MUS	134	Saudi Arabia	SAU	167	Uganda	UGA
102	Mayotte	MYT	135	Senegal	SEN	168	Ukraine	UKR
103	Mexico	MEX	136	Serbia	SRB	169	United Arab Emirates	ARE
104	Micronesia, Fed. States	FSM	137	Seychelles	SYC	170	Uruguay	URY
105	Moldova	MDA	138	Sierra Leone	SLE	171	Uzbekistan	UZB
106	Mongolia	MNG	139	Singapore	SGP	172	Vanuatu	VUT
107	Montenegro	MNE	140	Slovenia	SVN	173	Venezuela	VEN
108	Montserrat	MSR	141	Solomon Islands	SLB	174	Vietnam	VNM
109	Morocco	MAR	142	Somalia	SOM	175	Virgin Islands (UK)	VGB
110	Mozambique	MOZ	143	South Africa	ZAF	176	Wallis & Futuna	WLF
111	Myanmar	MMR	144	Sri Lanka	LKA	177	West Bank & Gaza Strip	WBG
112	Namibia	NAM	145	St. Helena	SHN	178	Yemen	YEM
113	Nauru	NRU	146	St. Kitts-Nevis	KNA	179	Zambia	ZMB
114	Nepal	NPL	147	St. Lucia	LCA	180	Zimbabwe	ZWE
115	Netherlands Antilles	ANT	148	St.Vincent & Grenadines	VCT			
116	New Caledonia	NCL	149	States Ex-Yugoslavia	SFR			
117	Nicaragua	NIC	150	Sudan	SDN			
118	Niger	NER	151	Suriname	SUR			
119	Nigeria	NGA	152	Swaziland	SWZ			
120	Niue	NIU	153	Syria	SYR			
121	Northern Marianas	MNP	154	Tajikistan	TJK			
122	Oman	OMN	155	Tanzania	TZA			
123	Pakistan	PAK	156	Thailand	THA			
124	Palau	PLW	157	Timor-Leste	TMP			
125	Panama	PAN	158	Togo	TGO			
126	Papua New Guinea	PNG	159	Tokelau	TKL			
127	Paraguay	PRY	160	Tonga	TON			
128	Peru	PER	161	Trinidad and Tobago	TTO			
129	Philippines	PHL	162	Tunisia	TUN			
130	Qatar	QAT	163	Turkey	TUR			
131	Rwanda	RWA	164	Turkmenistan	TKM			
132	Samoa	WSM	165	Turks and Caicos Islands	TCA			

APPENDIX 2: LIST OF VARIABLES AND DATA SOURCES

Variable label	Definition	Data Source
$\log A^C$	Log of the amount of climate finance commitment or disbursement in million US$ constant 2010	(OECD, 2012)
$\log A^T$	Log of the amount of overall aid commitment or 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	Carbon intensity at year-t/carbon intensity at year t-1	Author's calculation (GDP and CO_2 are from WDI 2013)
lnforest	Log of forest area in 1000Ha	(FAO 2013)
marine	Marine protected areas (% of territorial waters)	(WDI 2013)
deforest	Gain or loss in ratio 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)	(WDI 2013)
lnpop	Log of population size	(WDI 2013)
fdiinflow	Percentage of Foreign Direct Investment (FDI) inflow from GDP	(WDI 2013)
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)
reddpluss	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: PEARSON CORRELATION COEFFICIENTS

		Commitment		Disbursement		rci	lnforest	marine	deforest
		$\log A^p$	$\log A^T$	$\log A^p$	$\log A^T$				
Commitment	$\log A^p$	1.0000							
	$\log A^T$	0.4505*	1.0000						
		0.0000							
Disbursement	$\log A^p$	0.6736*	0.4728*	1.0000					
		0.0000	0.0000						
	$\log A^T$	0.3914*	0.9342*	0.4292*	1.0000				
		0.0000	0.0000	0.0000					
rci		0.0681	-0.0525	-0.0384	-0.0340	1.0000			
		0.1464	0.1511	0.4310	0.3578				
lnforest		0.2716*	0.6105*	0.3086*	0.5612*	0.0291	1.0000		
		0.0000	0.0000	0.0000	0.0000	0.4228			
marine		-0.0211	0.0521	0.0016	0.0391	0.0003	0.1715*	1.0000	
		0.5623	0.0508	0.9660	0.1472	0.9933	0.0000		
deforest		0.0781*	-0.0792*	0.1020*	-0.0919*	0.0318	-0.4015*	-0.1132*	1.0000
		0.0127	0.0005	0.0014	0.0001	0.3778	0.0000	0.0000	
govern		-0.0050	-0.3938*	-0.0166	-0.4262*	0.1287*	-0.4491*	-0.1020*	0.1893*
		0.8730	0.0000	0.6043	0.0000	0.0003	0.0000	0.0001	0.0000
lngdppc		-0.0428	-0.5191*	-0.0478	-0.5506*	0.0619	-0.4008*	-0.0931*	0.2036*
		0.1805	0.0000	0.1430	0.0000	0.0861	0.0000	0.0003	0.0000
lninfant		-0.0147	0.3286*	-0.0590	0.3643*	-0.1119*	0.3497*	0.0966*	-0.2594*
		0.6403	0.0000	0.0654	0.0000	0.0017	0.0000	0.0001	0.0000
lnpop		0.3976*	0.7423*	0.4364*	0.7119*	-0.0992*	0.7008*	0.0819*	-0.1499*
		0.0000	0.0000	0.0000	0.0000	0.0052	0.0000	0.0009	0.0000
fdiinflow		-0.0718*	-0.1587*	-0.0898*	-0.1440*	0.1254*	-0.1796*	-0.0463	-0.0082
		0.0235	0.0000	0.0055	0.0000	0.0005	0.0000	0.0737	0.7197
democracy		0.0110	0.1148*	0.0507	0.0426	-0.0030	0.1450*	0.0855*	-0.1760*
		0.7402	0.0000	0.1386	0.0999	0.9358	0.0000	0.0026	0.0000
xcolony		0.0028	0.0859*	-0.0164	0.0657*	-0.0666	0.0190	-0.0849*	-0.0611*
		0.9271	0.0001	0.6032	0.0035	0.0611	0.4185	0.0006	0.0038
reddplus		0.0919*	0.3299*	0.1142*	0.2944*	-0.0649	0.4893*	0.1624*	-0.2644*
		0.0031	0.0000	0.0003	0.0000	0.0680	0.0000	0.0000	0.0000
smallisland		-0.2166*	-0.5115*	-0.2554*	-0.5249*	0.0559	-0.4110*	0.0052	0.0606*
		0.0000	0.0000	0.0000	0.0000	0.1161	0.0000	0.8320	0.0041
opecmember		-0.0729*	0.0134	-0.0724*	0.0271	-0.0285	0.0586*	0.1210*	0.0067
		0.0191	0.5481	0.0220	0.2275	0.4226	0.0123	0.0000	0.7503
lnco2		0.3301*	0.4133*	0.4129*	0.3872*	0.0160	0.3946*	0.0352	0.0183
		0.0000	0.0000	0.0000	0.0000	0.6538	0.0000	0.1767	0.4299
lnch4		0.3491*	0.4106*	0.4810*	0.3547*	-0.0791	0.7463*	0.2188*	-0.1834*
		0.0004	0.0000	0.0000	0.0000	0.3441	0.0000	0.0034	0.0024
lnn2o		0.3093*	0.3542*	0.3376*	0.3063*	-0.3904*	0.7229*	0.3134*	-0.1683*
		0.0021	0.0000	0.0037	0.0000	0.0000	0.0000	0.0000	0.0058
lnhfcs		0.5276*	0.2082*	0.5251*	0.1552	-0.2621*	0.4354*	0.2696*	-0.4561*
		0.0000	0.0219	0.0001	0.0920	0.0136	0.0000	0.0070	0.0000
lnpfcs		0.3392	0.2800*	0.0984	0.2318	-0.0015	0.5720*	0.4061*	-0.1352
		0.0667	0.0317	0.5799	0.0827	0.9931	0.0000	0.0005	0.2117
lnsf6		0.3466*	0.4779*	0.3891*	0.3188*	0.1905	0.3504*	0.2675*	-0.0156
		0.0245	0.0000	0.0131	0.0033	0.1316	0.0002	0.0113	0.8615
lnghg		0.5433	0.2436	0.2255	0.2082	-0.9084*	0.7343*	-0.3132	-0.5317
		0.1640	0.4704	0.6269	0.5389	0.0328	0.0101	0.4118	0.0923

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

Continued in the next page.

	govern	lngdppc	lninfant	lnpop	fdiinflow	democracy	xcolony	reddplus
govern	1.0000							
lngdppc	0.7328*	1.0000						
	0.0000							
lninfant	-0.6566*	-0.8196*	1.0000					
	0.0000	0.0000						
lnpop	-0.4746*	-0.3635*	0.2311*	1.0000				
	0.0000	0.0000	0.0000					
fdiinflow	0.1435*	0.0954*	-0.0597*	-0.2237*	1.0000			
	0.0000	0.0000	0.0088	0.0000				
democracy	0.3632*	0.0234	-0.1497*	-0.0236	0.0102	1.0000		
	0.0000	0.3502	0.0000	0.3383	0.6842			
xcolony	-0.0423	-0.0861*	0.1988*	-0.0320	-0.0175	-0.0888*	1.0000	
	0.0544	0.0001	0.0000	0.1376	0.4358	0.0003		
reddplus	-0.1934*	-0.2480*	0.2010*	0.2991*	-0.0331	0.1837*	0.1271*	1.0000
	0.0000	0.0000	0.0000	0.0000	0.1407	0.0000	0.0000	
smallisland	0.2852*	0.1885*	-0.1848*	-0.5594*	0.1153*	0.1604*	0.2384*	-0.1664*
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
opecmember	-0.1284*	0.1648*	-0.0760*	0.1585*	-0.0806*	-0.2615*	0.0422*	-0.0545*
	0.0000	0.0000	0.0006	0.0000	0.0003	0.0000	0.0410	0.0084
lnco2	-0.0331	0.2290*	-0.2954*	0.7460*	-0.1508*	-0.0593*	-0.2067*	0.0412
	0.1564	0.0000	0.0000	0.0000	0.0000	0.0215	0.0000	0.0716
lnch4	-0.3897*	-0.0877	0.1776*	0.9134*	-0.3118*	-0.0590	-0.2030*	0.0529
	0.0000	0.1609	0.0042	0.0000	0.0000	0.3687	0.0008	0.3858
lnn2o	-0.3852*	-0.0947	0.1171	0.8746*	-0.3102*	-0.0879	-0.2339*	0.0479
	0.0000	0.1329	0.0625	0.0000	0.0000	0.1830	0.0001	0.4354
lnhfcs	0.1117	0.2795*	0.0987	0.4649*	-0.0059	0.3021*	0.0850	0.2951*
	0.1720	0.0005	0.2281	0.0000	0.9430	0.0003	0.2789	0.0001
lnpfcs	-0.3573*	-0.0769	0.3672*	0.6063*	0.1974	-0.3149*	0.0087	0.0989
	0.0019	0.5150	0.0013	0.0000	0.0941	0.0067	0.9361	0.3620
lnsf6	0.1519	0.3322*	0.1362	0.4636*	-0.2526*	0.4554*	0.1234	0.1664
	0.1068	0.0003	0.1483	0.0000	0.0067	0.0000	0.1670	0.0614
lnghg	0.2578	0.3419	-0.2531	0.5660	-0.0762	0.2960	0.4975	0.2143
	0.4440	0.3034	0.4527	0.0695	0.8239	0.4063	0.1194	0.5268

	smallisland	opecmember	lnco2	lnch4	lnn2o	lnhfcs	lnpfcs	lnsf6	lnghg
smallisland	1.0000								
opecmember	-0.1452*	1.0000							
	0.0000								
lnco2	-0.4755*	0.3248*	1.0000						
	0.0000	0.0000							
lnch4	-0.4386*	0.1196*	0.8615*	1.0000					
	0.0000	0.0493	0.0000						
lnn2o	-0.4613*	0.1583*	0.7594*	0.8770*	1.0000				
	0.0000	0.0096	0.0000	0.0000					
lnhfcs	-0.1737*	-0.0539	0.4861*	0.4256*	0.4055*	1.0000			
	0.0261	0.4928	0.0000	0.0000	0.0000				
lnpfcs	-0.5299*	0.1266	0.6966*	0.5732*	0.6147*	0.3736*	1.0000		
	0.0000	0.2425	0.0000	0.0000	0.0000	0.0008			
lnsf6	0.0738	0.0782	0.3660*	0.3392*	0.2781*	0.5781*	0.4462*	1.0000	
	0.4097	0.3819	0.0001	0.0001	0.0016	0.0000	0.0001		
lnghg	-0.3135	.	0.3571	0.5217	0.6538*	0.7650	1.0000*	-0.9526	1.0000
	0.3479	.	0.2810	0.0997	0.0403	0.1318	0.0000	0.1969	

APPENDIX 4: ROBUSTNESS CHECKS WITH HECKMAN SELECTION MODEL

	Commitment		Disbursement	
Climate finance	Selection (27)	Allocation (28)	Selection (29)	Allocation (30)
lnco2	0.151	0.075	0.047	0.188
	(1.615)	(0.435)	(0.455)	(0.797)
lnforest	0.109**	0.238**	0.165***	0.241**
	(2.541)	(2.271)	(3.553)	(2.249)
deforest	0.371***	0.700**	0.508***	0.760***
	(2.853)	(2.494)	(3.659)	(2.752)
govern	0.473***	1.355***	0.561***	1.221***
	(2.645)	(3.937)	(3.007)	(3.201)
lngdppc	-0.360**	-0.621**	-0.244*	-0.787**
	(-2.521)	(-2.281)	(-1.694)	(-2.339)
lninfant	0.071	-0.182	0.166	-0.315
	(0.361)	(-0.611)	(0.897)	(-0.917)
lnpop	0.139	0.759***	0.216	0.579*
	(1.145)	(3.622)	(1.584)	(1.887)
fdiinflow	0.010	0.058***	0.009	0.019
	(0.725)	(3.024)	(0.667)	(0.749)
democracy	0.027**	0.019	0.020	0.035
	(2.147)	(0.693)	(1.571)	(1.233)
xcolony	-0.039	-0.081	-0.021	-0.009
	(-0.230)	(-0.248)	(-0.116)	(-0.024)
reddplus	0.550***		0.601***	
	(3.250)		(2.851)	
χ^2	300.4		203.0	
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