ISSN 1756-7904

DEV INTERNATIONAL DEVELOPMENT University of East Anglia

Working Paper Series

Donor Characteristics and the Supply of Climate Change Aid

Aidy Halimanjaya and Elissaios Papyrakis

2012

University of East Anglia

Working Paper 42

The School of International Development, University of East Anglia
Norwich, NR4 7TJ, United Kingdom

DEV Working Paper 42

Donor Characteristics and the Supply of Climate Change Aid

Aidy Halimanjaya and Elissaios Papyrakis

First published by the School of International Development in October 2012.

This publication may be cited as:
Halimanjaya, A. & Papyrakis, E., 2012, Donor Characteristics and the Supply of Climate Change Aid, Working Paper 42, DEV Working Paper Series, The School of International Development, University of East Anglia, UK.

About the Authors
Aidy Halimanjaya is a Research Postgraduate at the School of International Development at the University of East Anglia, Norwich, UK.

Elissaios Papyrakis is a Senior Researcher at the Institute for Environmental Studies, Vrije Universiteit Amsterdam, De Boelelaan 1087, 1081 HV Amsterdam, the Netherlands.

Contact:
Email A.Halimanjaya@uea.ac.uk
School of International Development
University of East Anglia
Norwich, NR4 7TJ
United Kingdom
Tel: +44(0)1603 592338
Fax: +44(0)1603 451999

ISSN 1756-7904

About the DEV Working Paper Series

The Working Paper Series profiles research and policy work conducted by the School of International Development and International Development UEA (see below). Launched in 2007, it provides an opportunity for staff, associated researchers and fellows to disseminate original research and policy advice on a wide range of subjects. All papers are peer reviewed within the School.

About the School of International Development

The School of International Development (DEV) applies economic, social and natural science disciplines to the study of international development, with special emphasis on social and environmental change and poverty alleviation. DEV has a strong commitment to an interdisciplinary research and teaching approach to Development Studies and the study of poverty.

International Development UEA (formerly Overseas Development Group)

Founded in 1967, International Development UEA is a charitable company wholly owned by the University of East Anglia, which handles the consultancy, research, and training undertaken by the faculty members in DEV and approximately 200 external consultants. Since its foundation it has provided training for professionals from more than 70 countries and completed over 1,000 consultancy and research assignments. International Development UEA provides DEV staff with opportunities to participate in on-going development work, practical and policy related engagement which add a unique and valuable element to the School's teaching programmes.

For further information on DEV and the International Development UEA, please contact:

School of International Development
University of East Anglia, Norwich NR4 7TJ, United Kingdom
Tel: +44 (0)1603 592329
Fax: +44 (0)1603 451999
Email: dev.general@uea.ac.uk
Webpage: www.uea.ac.uk/dev

Abstract

This paper examines the links between donor country characteristics and the amount of aid allocated to climate-change related activities (hereafter 'climate aid'). We find the share of environmental expenditure in the government budget and the GDP per capita level of donors to significantly influence the amount of aid given to tackle climate change. The share of environmental expenditure positively affects the amount of aid committed to tackle climate change, while, paradoxically, wealthier donors appear to be less generous in terms of climate aid. We examine separately the impact of donor characteristics on climate aid commitment and disbursement, as well as the gap between the two. Furthermore, we observe that many donor countries underreport data on climate aid provision – we discuss potential explanations behind this, although we find weak statistical evidence of a selection bias of our original estimates.

Keywords: Climate Change, Aid, Donors.

1. Introduction

In recent years, many scholars have attempted to define the motives behind development aid. It is commonly argued that donor motives extend beyond the altruistic objective to improve the economy and well being of people in developing countries (McKinlay & Little 1977, Maizels & Nissanke 1984; Trumbull & Wall 1994; Alesina & Dollar 2000; Berthelemy & Tichit 2004; Hoeffler & Outram 2011). Lewis (2003) argues that this also holds for the case of environmental aid. The economic and political interests of donors are often much stronger determinants of environmental aid in comparison with the environmental needs of recipient countries. In the past decade, there has also been a significant increase in bilateral development aid aimed to fund activities that tackle climate change (Michaelowa & Michaelowa 2007; Ballesteros & Moncel 2010; Bierbaum & Fay 2010; Brown *et al.* 2010; ICTSD 2010; OECD 2011).

Having a more specific focus than environmental aid, climate aid largely aims at minimising GHG emissions (and to a lesser extent at financing climate change *adaptation*), which in the longer term can benefit both the donor as well as recipient countries. To our knowledge, there has been no prior attempt in the literature to empirically investigate the linkages between donor economic, political and institutional characteristics and their corresponding allocation of funds towards climate aid. We, hence, contribute to the literature by empirically examining the role of several donor characteristics on climate aid allocation for the 22 Development Assistance Committee (DAC) donors[1] in the last 12 years. We draw on the wider literature that investigates the links between donor characteristics and general development or environmental aid in order to develop our empirical framework for the case of climate aid. Chong and Gradstein (2008), for example, study the effect of donor characteristics on general aid provision and argue that countries with higher satisfaction of citizens towards government performance and larger income per capita tend to provide more foreign aid. Using project level data from the PLAID database, Hicks *et al.* (2008) find that wealthy donor countries are less likely to allocate their aid to projects that have negative environmental impacts, although their results are not robust to alternative empirical models. In addition, they also do not find any evidence that institutional/political characteristics, such as the strength of environmental lobby groups, affect the allocation of aid to environmental purposes. Our specific focus on assessing the country specific determinants of climate-change related aid provides a more direct contribution to the climate change discourse and policymaking.

Our analysis follows the methodology employed by Hicks *et al.* (2008), who apply panel regressions to investigate the political, economic, and institutional characteristics of donors in shaping the provision of environmental aid. Their study

[1] The list of the 22 DAC donor countries is provided in Appendix 1.

is the closest to the subject of our research, although with a broader focus on environmental aid. We include a similar set of determinants, as in Hicks *et al*. (2008), but also expand this with additional regressors (e.g. the share of donor national environmental expenditure in the government budget and the level of CO_2 emissions per capita, which proxy the importance given to environmental issues at the government level and the level of donor carbon intensity respectively). We expect that the share of donor environmental expenditure, the level of CO_2 emissions and the level of income per capita will positively affect the amount of aid allocated to climate-change related purposes. Furthermore, we contribute to the literature by considering and highlighting the possibility of a selection bias that can arise from the underreporting of climate aid data by donors. With the use of a Heckman selection model, we examine whether there is pattern explaining why some donor countries may underreport data on climate aid and explore how this might influence the estimates of our empirical specifications.

The next section looks at the current trends in climate aid. Section 3 studies empirically the connection between donor characteristics and the provision of climate aid. In section 4, we examine the extent of a selection bias in our results with the use of a Heckman Selection Model and identify factors that possibly affect donor-reporting behaviour. Section 5 concludes.

2. Trends in climate aid

In order to measure climate aid, we adopt the definition of climate-change related aid from the Rio Marker[2] OECD Creditor Rating System (CRS), which states that aid can be classified as related to climate change if it:

> *"…contributes to the objective of stabilisation of Greenhouse Gas (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" (Article 2 of the UNFCCC, UNITED-NATIONS 1992; OECD 2009a; OECD 2009b)"*

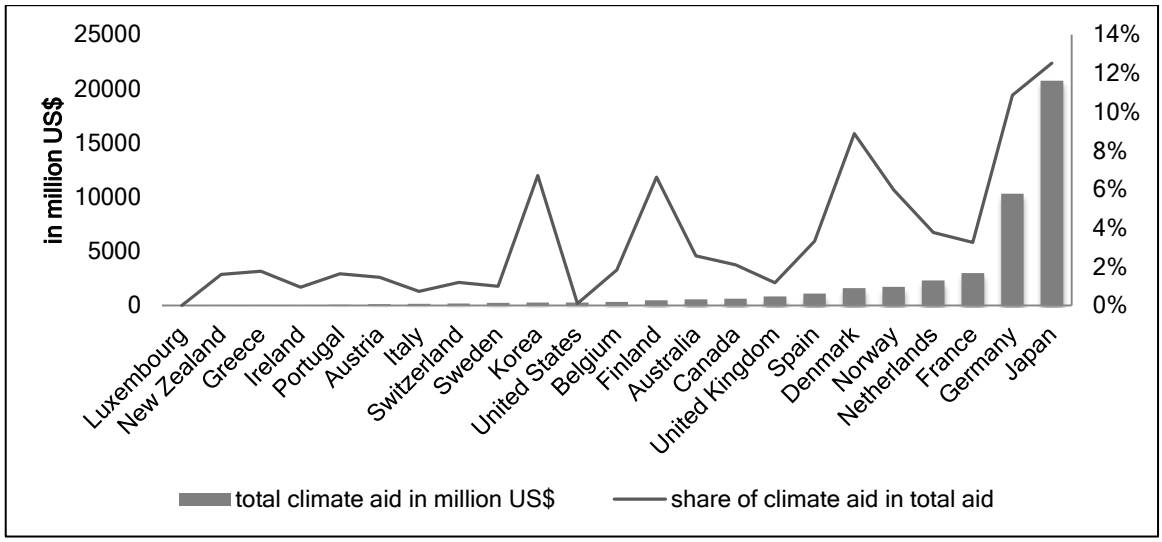
Although the definition focuses on the role of climate aid in mitigating GHG emissions, there have been, to a lesser extent, funds allocated for climate change adaptation purposes[3]. Donor countries vary with respect to their allocation to climate-change related activities. Although Japan started to report data on climate aid commitment only since 2002, it currently has the largest aid contribution to

[2] The OECD Rio Marker was established in 1998 to monitor the transfer of climate aid and other types of aid under the Rio convention from mainly 23 DAC donors to developing countries. The reporting to the OECD Rio Marker committee became mandatory from 2007 (Benn 2010). Prior to 2007, the data of Rio Marker was collected in a trial basis. During this trial period, we find some countries are more responsive in reporting their climate aid than others. Section 4 focuses on possible explanations behind this under-reporting behaviour.

[3] Disaggregated data on climate aid for mitigation and adaptation are only available for 2010.

climate change both in absolute values, as well as a share in total aid (see Figure 1). Japan allocated 12.5 per cent of its total aid from 2002 to 2009 to climate change (with a cumulative value close to US$20 billion). This position is followed by Germany, where the share of climate aid in total aid amounts to 10.9 per cent. The contribution of climate aid in total aid has increased significantly in the past decade (see Figure 2). This increasing trend reveals a growing interest in allocating aid towards climate-change related activities.

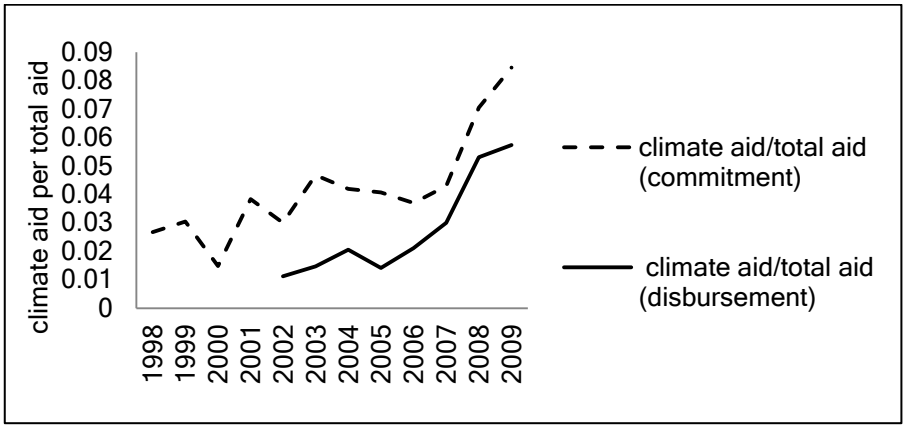
Figure 1. Donors' commitment to climate aid (1998-2009)



Data Source: OECD (2009c)

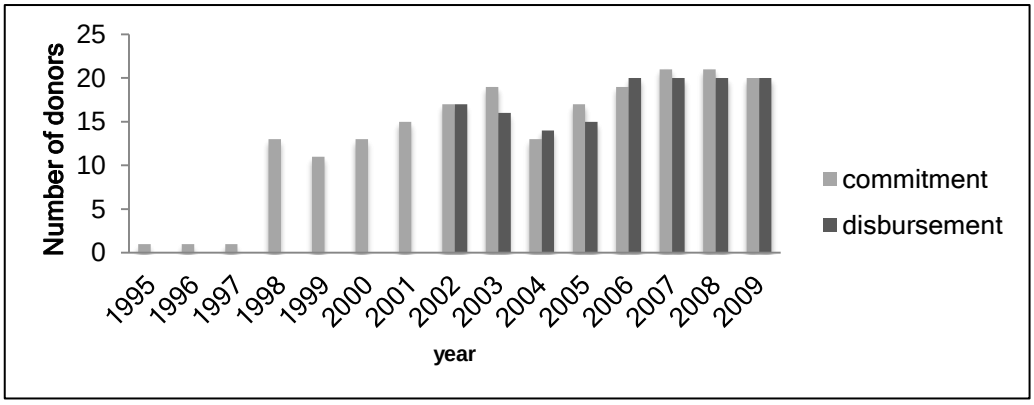
Two additional observations are worth noting. First, actual climate aid disbursement has been consistently lower than climate aid commitment (although also increasing over time). Donors take several years to fulfill a certain level of their commitment. Interestingly, the disbursement-commitment gap narrowed between 2007 and 2008 and, as a whole, climate aid disbursement grew faster than climate aid commitment. Between 1998 and 2009, the amount of bilateral climate aid commitment escalated from US$1.2 to US$9.2 billion (i.e. by 7.6 times). On the other hand, there was a nine-fold increase in the *disbursed* amount of climate aid (from US$600 million to US$5.4 billion between 2002 to 2009 − see Appendix 2, Table A1). Second, there has been an increase over time in data reporting with respect to climate aid (Figure 3). Nevertheless, some countries have consistently underreported data on climate aid (Appendix 2, Figure A1). Before 1998, only the Netherlands reported its climate aid commitment. This triggers a question on whether particular factors have led some donors to report more consistently on climate aid than others (which we discuss in more detail in Section 4).

Figure 2. Trend in climate aid commitment and disbursement



Data Source: OECD (2009c)

Figure 3. Number of reporting donors for climate aid commitment and disbursement



Data Source: OECD (2009c)

3. The Empirics of Climate Aid Supply

To estimate the impact of donor characteristics on climate aid, we make use of a multivariate panel data regression model. We employ panel regressions to control both for spatial and temporal variation. Earlier empirical analyses have adopted similar empirical frameworks for other types of aid. Chong and Gradstein (2008) employ donor Fixed Effects panel and cross-country regression analysis to identify the impact of donor characteristics on total aid. Hicks *et al.* (2008) use both Pooled OLS and Fixed Effects panel regressions to estimate the effect of donors' political and economic characteristics on the allocation of bilateral and multilateral environmental aid and non-environmental aid.

3.1. Climate Aid Data

Data on climate aid commitment and disbursement for the 22 Development Assistance Committee (DAC) Donors are provided by the Rio Marker database of

the OECD CRS (OECD 2009c)[4]. The Rio Marker OECD CRS database 2009 classifies projects funded by aid into seven categories depending on the purpose of climate aid 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. The first category refers to climate aid provided exclusively for climate-change related purposes, while, for example, the fourth category corresponds to funding that aims at both biodiversity protection as well as climate change mitigation (or adaptation). When we make use of the term "climate aid", we refer to the first category. "Total climate aid" instead refers to the aggregate amount that corresponds to categories (1), (4), (5), and (6) of the Rio Marker. While data availability is slightly higher for "total climate aid" than "climate aid" (215 instead of 199 observations), our analysis primarily focuses on the determinants of the "climate aid" variable which corresponds to an exclusive commitment to climate change mitigation. Appendix 3 provides data description and sources for all variables used in our analysis. Appendix 4 provides corresponding descriptive statistics.

3.2. Methodology

We assume that climate aid (A_{it}^{j}) for donor *i* at period *t* depends on the share of environmental expenditure in the government budget (*environexp*), the level of income per capita (*loggdppc*), the level of CO_2 emissions per capita (*logCO2pc*) and a vector list of other explanatory variables Z. The reasoning behind the inclusion of this set of explanatory variables in the specification will be discussed later in the analysis. The superscript *j* denotes our four climate aid measurements of interest; namely the logarithm of climate aid commitment ($\log A^{c}$), the logarithm of climate aid disbursement ($\log A^{d}$), the disbursement-commitment ratio ($\frac{A^{d}}{A^{c}}$), and the logarithm of the total climate aid commitment ($\log A^{TOT}$). The period of analysis is 1998-2009 for the aid commitment regressions and 2002-2009 for the ones explaining aid disbursement and disbursement-commitment differences. Hence, our generic empirical specification is of the following form:

$$A_{it}^{j} = \propto_0 + \propto_1 environexp_{it} + \propto_2 loggdppc_{it} + \propto_3 logCO2pc_{it} + \propto_4 Z_{it} + \varepsilon_{it} \qquad (1)$$

We estimate specification (1) using fixed effects that controls for unobserved heterogeneity across donor countries. Hence, the residual term ε_{it} in regression (1) is composed of both a time-invariant *unobservable* individual-specific effect (ε_i) and the remainder disturbance (ν_{it}), which varies across donor countries and time. Time variant effects are controlled using time dummies.

[4] Data on climate aid commitment and disbursement are available between 1998-2009 and 2002-2009 respectively.

3.3. Empirical Analysis

In Table 1 we examine the dependence of climate aid commitment on several variables. Our first explanatory regressor is *environexpen* which is measured by the environmental expenditure in the government budget. We use this as a proxy of the importance given to environmental issues at the government level. Data are provided by the Government Finance Statistics (GFS) of the International Monetary Fund (IMF 2010). We also include *logCO2pc* and *loggdppc* as explanatory variables – these measure the logarithm of income per capita and CO_2 emissions per capita respectively. Data on income per capita are provided by the World Development Indicators database of the World Bank (WDI 2011). We use data on CO_2 emissions per capita produced by Boden *et al.* (2011). In column (1) we add as explanatory variables an index capturing the composition of donor government, where higher values correspond to more left-wing government orientation (*leftgov*), a measure of regulatory quality that captures the ability of government to formulate and implement sound policies and regulations (*regulquality*), the logarithm of total amount of development aid committed (*logtotalaid*) and the logarithm of population (*logpopulation*). Our data on the left-right wing government composition is obtained from the Database of Political Institutions (DPI) (Keefer 2010). DPI uses a coding system to classify party orientation with respect to economic policy: (1) is for governments defined as conservative, Christian democratic, or right-wing; (2) for centrist; and (3) for communist, socialist, social democratic, or left-wing. Data on regulatory quality is provided by Kaufmann *et al.* (2011). The index of regulatory quality ranges from -2.5 to 2.5 (where higher values correspond to higher scores of quality). Data on total development aid and population are provided by the OECD (2009c) and the World Development Indicators (WDI 2011) respectively.

The share of environmental expenditure in the government budget is found to be positively and significantly associated with climate aid commitment[5]. This result indicates the possibility of interplay between domestic environmental policy and international aid policy, especially in the allocation of aid to fund climate change related activities (in other words, climate aid can be seen as a policy instrument that supports the 'internationalisation' of domestic environmental policy, see e.g. Keohane & Miloger 1996; Keohane 2011; Tews *et al*. 2003; Busch & Jörgens 2005).

On the contrary, we find that the level of donor income per capita is not positively correlated with the amount of aid allocated to climate-change related activities and the relationship is statistically significant. In other words, wealthier donors tend to have a lower climate aid commitment, other things equal. The

[5] One can calculate that a 1 per cent increase in the share of donor environmental expenditure corresponds approximately to a 15 per cent rise in climate aid.

negative correlation between GDP per capita and climate commitment contradicts earlier findings by Hicks *et al*. (2008) who find a positive relationship for the case of broader environmental aid (although insignificant when controlling for fixed effects). There is also a statistically significant positive correlation between donor population and climate aid commitment, as expected (i.e. larger economies tend to provide more climate aid)[6]. Once controlling for GDP per capita levels, more populous economies are expected to have both more tax-paying citizens who can support climate finance, as well as more consumers and CO_2 emitters, whose environmental burden necessitates increased participation in international climate aid. The rest of the coefficients are of low statistical significance. The 'dirtier' economies with a higher carbon emissions to population ratio (*logCO2pc*) are characterised by larger climate aid commitment, other things equal. This may be explained by the fact that most of the high carbon emitters face more stringent commitments in terms of emission reductions (e.g. through the Kyoto mechanisms). We find that left-wing governments tend to commit less funds towards climate aid, which contradicts earlier findings by Neumayer (2003, 2004) and Hicks *et al*. (2008) for the case of broader environmental aid. Our measure of regulatory quality of donor countries is also positively associated with climate aid – more efficient governments are more likely to spare resources for global environmental goods, as in the case of climate change mitigation. The Kaufmann dataset provides data for five more institutional indices that capture different dimensions of the quality of governance: rule of law, voice accountability, control of corruption, political stability, and government effectiveness. We find that all these institutional variables are highly correlated with one another (see the shaded area in Appendix 5). To avoid multicollinearity, we avoid inserting the variables simultaneously into the same specification and we test their impact on climate aid *separately*. Table 2 provides the corresponding estimates when we replicate the specification of column (1) by consecutively replacing the index of regulatory quality with the other five institutional indices (which are all positive but insignificant, similar to the results in Hicks *et al*. (2008, p.174) – the regulatory quality variable of Table 1 has the highest coefficient amongst all Kaufmann institutional variables). We also find that countries that are generally more generous in providing aid also tend to commit more funds to climate aid. Donor countries that have raised their general aid commitment (e.g. as part of their efforts to meet the internationally committed target of allocating at least 0.7 per cent of GDP towards aid), might, hence, also channel more funds towards climate aid activities.

In columns (2)-(3) of Table 1 we progressively include in alternate order a series of additional regressors that can potentially add to the explanatory power of our empirical model. For all these alternative specifications, there is little change in the qualitative predictions of the variables discussed above. In column (2) we

[6] Similar results hold when we control for the level of GDP instead of the level of population.

introduce the share of the overall population with tertiary education as a proxy for environmental awareness of the public in each donor country. We opt for tertiary education, since there is little variation in primary and secondary enrollment rates across donor countries. While tertiary education is positively linked to climate aid attainment, the relationship is not statistically significant. In column (3) we test for a non-linear relationship between GDP per capita and climate aid commitment, as hypothesised by the Environmental Kuznets Curve (EKC). According to the EKC literature, environmental quality and corresponding commitment may decline at earlier stages of economic development but start improving after a certain threshold level of income per capita (Dietz & Rosa 1997). Richer economies, for instance, may face less stringent budget constraints and place a higher priority on environmental issues and climate change mitigation. We, find, though, only weak evidence of such a non-linear relationship between income levels and climate aid, and the turning point, anyway, corresponds to an excessively high income level.

Table 1. Determinants of Climate Aid Commitment

Dependent variable: log of climate aid commitment, 1998 to 2009 ($\log A^c$)	(1)	(2)	(3)
environexpen	2.734***	2.806**	2.777***
	(4.212)	(2.893)	(3.753)
logCO2pc	2.771	3.455	2.528
	(0.855)	(1.134)	(0.730)
loggdppc	-18.854**	-18.085	-101.250
	(2.417)	(1.574)	(0.370)
leftgov	-0.340	-0.470*	-0.354
	(-1.451)	(-1.871)	(-1.388)
regulquality	2.153	2.453	1.979
	(0.799)	(0.883)	(0.647)
logtotalaid	1.299	1.243	1.256
	(1.102)	(0.964)	(1.164)
logpopulation	31.454**	47.481**	31.315**
	(2.584)	(2.461)	(2.419)
tertiaryed		1.939	
		(0.406)	
loggdppc2			4.021
			(0.303)
Constant	-320.358	-583.699	102.780
R-Squared (overall)	0.074	0.004	0.075
R-Squared (between)	0.119	0.019	0.121
R-Squared (within)	0.335	0.359	0.336
N	106	95	106

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

Table 2. Determinants of Climate Aid Commitment – Institutional Variables

Dependent variable: log of climate aid commitment 1998 to 2009 ($\log A^c$)	(4)	(5)	(6)	(7)	(8)
environexpen	2.860***	2.959***	3.317***	2.840***	2.873***
	(4.723)	(4.585)	(3.628)	(4.195)	(3.712)
logCO2pc	2.798	2.952	2.588	2.450	3.045
	(0.827)	(0.864)	(0.731)	(0.744)	(0.944)
loggdppc	-20.618**	-20.719**	-21.094**	-21.342**	-21.001**
	(-2.742)	(-2.654)	(-2.540)	(-2.689)	(-2.593)
leftgov	-0.333	-0.349	-0.334	-0.368	-0.375
	(-1.307)	(-1.364)	(-1.315)	(-1.407)	(-1.456)
logtotalaid	1.234	1.310	1.370	1.325	1.288
	(1.034)	(1.153)	(1.243)	(1.170)	(1.166)
logpopulation	35.250**	32.853**	32.844**	37.307*	29.869*
	(2.658)	(2.759)	(2.282)	(1.836)	(1.836)
ruleoflaw	1.736				
	(0.457)				
voiceaccount		0.522			
		(0.204)			
contcorrupt			2.148		
			(1.129)		
polstability				0.963	
				(0.404)	
goveffective					-0.601
					(-0.419)
Constant	-363.963	-320.961	-322.603	-391.523	-265.959
	(-1.673)	(-1.484)	(-1.226)	(-1.160)	(-0.991)
R-squared (overall)	0.073	0.069	0.076	0.070	0.066
R-squared (between)	0.119	0.119	0.124	0.114	0.105
R-squared (within)	0.326	0.322	0.336	0.326	0.324
N	106	106	106	106	106

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

In Table 3 we estimate equation (1) using alternative climate aid variables. In column (9) we, first, switch focus to climate aid disbursement ($\log A^d$), rather than commitment. Data on climate aid disbursement are available for a shorter period of time (2002-2009). The statistical significance of the model is rather weak, with only the population variable being significantly and positively linked to climate aid disbursement (similarly to climate aid commitment). Historically, climate aid disbursement has been lagging behind climate aid commitment (the disbursement-commitment ratio ($\frac{A^d}{A^c}$) for all donors has been in the range between 22–66 per cent). In column (10) of Table 2 we examine whether the magnitude of this ratio depends on donor characteristics. Statistical results are again weak, with *environexpen* being the only variable significantly (and negatively) affecting the ratio – in other words, while donor countries with a high share of environmental expenditure in the national budget commit more funds to climate aid (see Table 1),

they are also the ones who fail to fulfill their targets (Table 2, column (10)). In column (11) we use *total climate aid* ($\log A^{TOT}$) as our dependent variable (i.e. the amount of climate aid 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). Results are similar in sign and magnitude with the ones presented when we focus exclusively on *climate aid* (see column (1) of Table 1). A high share of environmental expenditure and high level of population correspond to increases *total* climate aid commitment. The opposite holds for high levels of GDP per capita (as well as donors with left-wing oriented governments).

Table 3. Alternative Climate Aid Variables

Dependent variable:	Climate aid disbursement ($\log A^d$) 2002 – 2009	Climate aid disbursement-commitment ratio ($\frac{A^d}{A^c}$) 2002 – 2009	Total climate aid commitment ($\log A^{TOT}$) 1998 – 2009
			(11)
environexpen	0.111	-80.258***	2.285**
	(0.124)	(-2.962)	(2.877)
logCO2pc	-2.918	-23.530	2.419
	(-1.429)	(-0.537)	(0.909)
loggdppc	-21.062	-252.280	-23.411***
	(-1.613)	(-1.092)	(-3.717)
leftgov	-0.148	0.045	-0.373**
	(-0.866)	(0.025)	(-2.338)
regulquality	-1.274	57.893	0.969
	(-0.731)	(0.634)	(0.468)
logtotalaid	-0.099	-1.257	1.140
	(-0.226)	(-0.092)	(1.311)
logpopulation	50.855**	-81.776	30.782***
	(2.640)	(-0.368)	(4.155)
Constant	-639.599	3821.541	-260.894*
	(-1.660)	(0.791)	(-1.946)
R-squared	0.041	0.053	0.058
R-squared	0.089	0.069	0.105
R-squared	0.534	0.254	0.473
N	87	87	111

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

4. Underreporting of Climate Aid Data: Causes and Effects

In this section we examine the underreporting pattern of climate aid data by some donor countries and explore both the possible causes of such behaviour, as well as its consequences in terms of biasing our prior estimates. In order to correct for a selection bias arising from the use of non-randomly reported climate aid data by donors, we re-estimate equation (1) using Heckman Selection Method (or Type 2

Tobit model, see Amemiya 1985 and Kyriazidou 1997). Statistical inferences may, for instance, not extend to the unobserved group (i.e. for the set of missing observations due to underreporting). The Heckman Selection Method consists of two steps. First, it estimates a *selection equation*, where the propensity to report (or not) on climate aid depends on a number of factors. In this step (which is equivalent to a Probit regression) we hypothesise that reporting can be influenced by the level of government effectiveness (*goveffective*) - we use the corresponding proxy capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures from the Kaufmann dataset. The index ranges from -2.5 to 2.5 (where higher values correspond to higher scores of government effectiveness). We expect government efficiency to translate into increased transparency with respect to data reporting. We are also interested to see whether the extent of climate aid reporting varies between 'dirtier' and 'cleaner' donors measured by differences in their carbon emissions to population ratio (*logCO2pc*). It is also worth exploring whether ratification of the Kyoto Protocol influences the reporting behaviour of donor countries – we, hence, include a 0-1 dummy variable (*kyotoprot*) that captures this dimension. Data are taken from the Environmental Treaties and Resource Indicators (CIESIN-SEDAC 2011). Results are presented in column (12) of Table 4. One can observe that government effectiveness and ratification of the Kyoto Protocol increase data reporting, while donors with a high level of emissions per capita tend to underreport. In column (13) of Table 4 we add two more variables that could further explain the underreporting behaviour of some donor countries: a variable capturing the level of *democracy* (captured by the 0-10 index from the Polity IV dataset (Marshall *et al*. 2011), where larger values correspond to higher levels of democracy) as well as the average level of income per capita (*loggdppc*). More democratic donor countries tend to be more transparent in data provision and richer economies seem to report more, possibly by having more resources available for dissemination and setting-up detailed national statistics accounts (although both mechanisms are not statistically significant). We test for collinearity between explanatory variables using Variance Inflation Factors (VIFs) and find that VIFs were below 10 indicating low levels of collinearity (Puhani 2000).

Table 4. Climate Aid Reporting

Dependent variable: Reporting on Climate Aid Commitment	(12)	(13)
goveffective	1.271***	1.063***
	(0.294)	(0.250)
logCO2pc	-2.063***	-2.150*
	(0.592)	(0.596)
kyotoprot	1.721***	1.556**
	(0.634)	(0.718)
democracy		0.416
		(0.286)
loggdppc		0.541
		(0.917)
Constant	-14.392	-24.234
Pseudo R^2	0.260	0.278
N	151	151

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

In the second step of Heckman Selection Model, the residuals of the selection equation are used to construct a selection bias control factor and equation (1) is repeated with the additional information to infer values for parameters for the whole ('uncensored', using the Heckman Selection terminology) population. We rerun the specification of column (1) in Table (1) using as selection models the two climate aid reporting specifications of Table 4. Results of the new *output equation* are summarised in Table 5 (columns (14) and (15) make use of the selection models of columns (12) and (13) of Table 4 respectively). With the exception of the total aid variable (*logtotalaid*), all other variables now appear to be insignificant.

Although Table 4 suggests that there is some underreporting behaviour by certain donors (influenced by the level of government effectiveness, CO_2 emissions per capita and the ratification of Kyoto), the output regressions of the Heckman Selection Model (Table 5) provide little support that this severely biases our prior estimates on the determinants of climate aid commitment (Table 1). The level of correlation (*rho*) between the error terms of the selection and output regressions should be non-zero (a standard assumption in the Heckman Selection Model, whose violation leads to biased estimates) – for our two specifications, the corresponding *Chi*-Squared statistics reject the hypothesis of a non-zero correlation (see Table 5 – the last row provides the probabilities of accepting *rho* being equal to zero). For this reason, results need to be interpreted with caution – while there is a tendency for certain donors to underreport (e.g. those with limited government efficiency and high emission levels), there is only weak statistical support in favour of a selection bias (and the validity of the corresponding estimates in Table 5).

Table 5. Determinants of Climate Aid Commitment (Heckman Selection Model)

Dependent variable: log of climate aid commitment, 1998 to 2009 (log A^c)	(14)	(15)
environexpen	-0.584	-0.571
	(1.724)	(1.722)
logCO2pc	-0.016	0.077
	(1.533)	(1.591)
loggdppc	1.982	1.972
	(2.754)	(2.817)
leftgov	-0.197	-0.194
	(0.242)	(0.242)
regulquality	1.168	1.111
	(1.121)	(1.107)
logtotalaid	1.203**	1.194**
	(0.571)	(0.572)
logpopulation	-0.036	-0.026
	(0.729)	(0.731)
Constant	-27.432	-26.725
R-Squared (overall)	0.074	0.004
R-Squared (between)	0.119	0.019
R-Squared (within)	0.335	0.359
N (Censored/Uncensored)	151 (45/106)	151 (45/106)
Rho non-zero	Rejected chi2= 0.05 Prob > chi2 = 0.825	Rejected chi2= 0.59 Prob > chi2 = 0.441

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

5. Conclusion

While donors' commitment towards climate change activities has increased considerably over the last decade, some donor countries have responded more generously than others in terms of climate aid supply. To our knowledge, this is the first empirical paper that attempts to explicitly probe into the determinants of climate aid supply and the links to donors' characteristics. We find that donor countries with a high share of environmental expenditure in their national budgets tend to commit more funds towards climate change once we control for population size and emission levels. We also find that wealthier donors, other things equal, tend to be less generous in terms of climate aid provision. Furthermore, we observe that some donor countries underreport data on their climate aid supply. We examine whether there is any consistent pattern behind the reporting behaviour of donor countries and find that government effectiveness and ratification of the Kyoto protocol are associated with increased reporting (although there is weak statistical evidence that this biases our results). On the contrary, donor countries with high CO_2 emissions tend to underreport.

We have various extensions of our analysis in mind. First, follow-up empirical analysis should probe into climate change aid from the recipient side. Panel data analysis should highlight which country characteristics ensure that some recipients are more successful than others in attracting climate aid. Second, a next step would involve bringing the supply and demand side of climate aid together. Pairing donor-recipient data on climate aid may reveal interesting patterns, for instance in terms of the spatial dimension of aid distribution or the role of colonial ties. Third, fresh data that separate climate aid between mitigation and adaptation may also shed light into any diverging patterns observed for the disaggregated aid distribution. Donor countries can prioritise funding in different type of activities, dependent on the policy agenda set at home.

References

Alesina, A., & Dollar, D. (2000). Who gives foreign aid to whom and why? *Journal of Economic Growth, 5*(1), 33-63.

Amemiya, T. (1985). *Advanced econometrics*. Cambridge: Harvard University Press.

Angrist, J. D., & Newey, W. K. (1991). Over-identification tests in earnings functions with fixed effects. *Journal of Business & Economic Statistics, 9*, 317-323.

Ballesteros, A., & Moncel, R. (2010). *Additionality of climate finance*: World Resource Institute.

Baltagi, B. H., Bresson, G., & Pirotte, A. (2007). Testing the fixed effects restrictions? A Monte Carlo study of Chamberlain's Minimum Chi-Squared test. *Center for Policy Research Working Paper 115*.

Benn, J. (2010). Monitoring aid flows targeting the objectives of the Rio conventions: climate-change-related aid. Development Co-operation Directorate OECD.

Berthelemy, J.-C., & Tichit, A. (2004). Bilateral donors' aid allocation decisions: a three-dimensional panel analysis. *International Review of Economics & Finance, 13*(3), 253-274.

Bierbaum, R., & Fay, M. (2010). *World Development Report 2010: Development and Climate Change*. Washington, DC: World Bank.

Bode, S. (2004). Equal emissions per capita over time – a proposal to combine responsibility and equity of rights for post-2012 GHG emission entitlement allocation. *European Environment, 14*(5), 300-316.

Boden, T., Marland, G., & Andres, B. (2011). National CO2 rmissions from fossil-fuel burning, cement manufacture, and gas flaring: 1751-2008. In CDIAC (Ed.). Boone, North Carolina: Carbon Dioxide

Brown, J., Cantore, N., & Velde, D. W. (2010). *Climate financing and development: friends or foes?* London: Overseas Development Institute.

Busch, P.-o., & Jörgens, H. (2005). The international sources of policy convergence: explaining the spread of environmental policy innovations. *Journal of European Public Policy, 12*(5), 860-884.

Chamberlain, G. (1982). Multivariate regression models for panel data. *Journal of Econometrics, 18*, 5-46.

Cheng, S., & Long, J. S. (2007). Testing for IIA in the Multinomial Logit Model. *Sociological Methods and Research, 35*(4).

Chong, A., & Gradstein, M. (2008). What determines foreign aid? The donors' perspective. *Journal of Development Economics, 87*(1), 1-13.

CIESIN-SEDAC. (2011). Environmental Treaties and Resource Indicators (ENTRI). Palisades, NY: CIESIN, Columbia University.

Dietz, T., & Rosa, E. A. (1997). Effects of population and affluence on CO2 emissions. *Proceedings of the National Academy of Sciences USA, 94*.

Hausman, J., & McFadden, D. (1984). Specification tests for the Multinomial Logit Model. *Econometrica, 52*(5), 1219-1240.

Hicks, R. L., Parks, B. C., Roberts, J. T., & Tierney, M. J. (2008). Chapter 6. The political market for environmental aid: why some donors are greener than others. *Greening Aid?, 1*(9), 159-184.

Hoeffler, A., & Outram, V. (2011). Need, merit, or self-interest—what determines the allocation of aid? *Review of Development Economics, 15*(2), 237-250.

ICTSD. (2010). *"Fast Start" climate funding ODA?* : International Centre for Trade and Sustainable Development.

IMF. (2010). IMF Government Finance Statistics (IMF GFS). In IMF (Ed.). Washington: ESDS International.

Kaufmann, D., & Kraay, A. (2002). *Governance indicators, aid allocation, and the Millennium Challenge Account*: The World Bank.

Keefer, P. (2010). DPI2010 Database of Political Institutions: changes and variable definitions. In D. R. Group (Ed.): The World Bank.

Keohane, R. O. (2011). International and domestic politics: climate change as a two level game: http://www.climatescienceandpolicy.eu/2010/06/international-and-domestic-politics-climate-change-as-a-two-level-game.

Keohane, R. O., & Milner, H. V. (Eds.). (1996). *Internationalization and domestic politics*. Cambridge: Cambridge University Press.

Kyriazidou, E. (1997). Estimation of a panel data sample selection model. *Econometrica, 65*, 1335–1364.

Lewis, T. L. (2003). Environmental aid: driven by recipient need or donor interests?*. *Social Science Quarterly, 84*(1), 144-161.

Maizels, A., & Nissanke, M. K. (1984). Motivations for aid to developing countries. *World Development, 12*(9), 879-900.

Marshall, M. G., Jaggers, K. & Gurr, T. R. (2011). *Polity IV Project: political regime characteristics and transitions, 1800-2010.* Societal-Systems Research Inc. and Colorado State University and University of Maryland (Emeritus).

McKinlay, R. D., & Little, R. (1977). A foreign policy model of U.S. bilateral aid allocation. *World Politics, 30*(1), 58-86.

Michaelowa, A., & Michaelowa, K. (2007). Climate or development: is ODA diverted from its original purpose? *Climatic Change, 84*(1), 5-21.

Michaelowa, A., & Michaelowa, K. (2010). Coding error or statistical embellishment? The political economy of reporting climate aid. *CIS Working Paper, 56*.

Neumayer, E. (2003). Are left-wing party strength and corporatism good for the environment? Evidence from panel analysis of aid pollution in OECD countries. *Ecological Economics, 45*(2).

Neumayer, E. (2004). The environment, left-wing political orientation and ecological economics. *Ecological Economics, 51*(3-4), 167-175.

OECD. (2002). Aid targeting the objectives of the Rio Conventions: OECD.

OECD. (2009a). OECD DAC track aid in support climate change mitigation and Adaptation: OECD.

OECD. (2009b). *Measuring aid targeting the objective of the United Nations Framework Convention on Climate Change*.

OECD. (2009c). *OECD Creditor Rating System (CRS) database. Accessed: July 2011*. Paris: OECD.

OECD. (2011). *Environment: climate change aid up to USD 22.9 billion in 2010, says OECD's Gurría.*http://www.oecd.org/document/0,3746,en_21571361_44315115_49170628_1_1_1_1,00.html.

Puhani, P. A. (2000). The Heckman Correction for sample selection and its critique. *Journal of Economic Surveys, 14*(1).

Tews, K., Busch, P.-O., & Jörgens, H. (2003). The diffusion of new environmental policy instruments. *European Journal of Political Research, 42*(4), 569-600.

Trumbull, W. N., & Wall, H. J. (1994). Estimating aid-allocation criteria with panel data. *The Economic Journal, 104*(425), 876-882.

UNITED-NATIONS. (1992). *United Nations Framework Convention on Climate Change. FCCC/INFORMAL/84 GE.05-62220 (E) 200705.*

WDI. (2011). *World Development Indicators*. *Accessed: July 2011.* The World Bank, Washington D.C.

APPENDIX 1: LIST OF DONOR COUNTRIES

No.	Donor Countries	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

Note: Luxembourg is not included due to a limited number of observations.

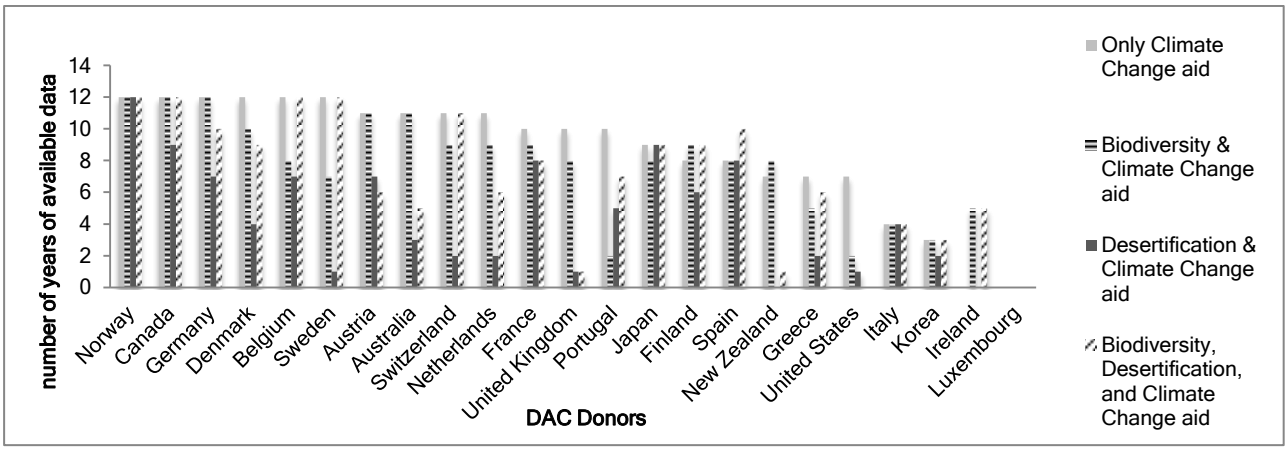
APPENDIX 2: SUMMARY DATA ON CLIMATE AID

Table A1. Donor commitment and disbursement of Climate Aid (in million US$, constant 2009 prices)

Year	Total Climate Aid (1)+(2)+(3)+(4)		Only Climate Change aid (1)		Biodiversity and Climate Change aid (2)		Desertification and Climate change aid (3)		Biodiversity, Desertification, and Climate change aid (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. Data Source: OECD (2009c)

Figure A1. Number of reporting years by each donor for each aid category under Rio Marker



Data Source: OECD (2009c)

APPENDIX 3: LIST OF VARIABLES AND DATA SOURCES

Type of Variables	Variable label	Definition	Data Source
Climate change related aid	$\log A^c$	Log of the amount of climate aid commitment in constant US$ 2009	OECD (2009c)
	$\log A^d$	Log of the amount of climate aid disbursement in constant US$ 2009	
	A^d/A^c	Disbursement-commitment ratio	
	$\log A^{TOT}$	Log of the amount of total climate aid in constant US$ 2009 (i.e. climate aid 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)	
Reporting on climate aid commitment		Availability of data on $\log A^c$; coded 1 if ≥ 0; coded 0 otherwise	
Carbon emissions	logCO2pc	Log of CO_2 in thousand metric tons of carbon divided by total population	Boden *et al.* (2011)
Level of wealth	loggdppc	Log of Gross Domestic Product (GDP) per capita in constant US$ 2009	WDI (2011)
Environmental expenditure	environexpen	Share of environmental expenditure in national budget	IMF (2010)
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 development aid	logtotalaid	Log of total development aid commitment in constant US$ 2009	OECD (2009c)
Institutional measures	regulquality	A -2.5 to 2.5 index of *regulatory quality* that captures the ability of government to formulate and implement sound policies and regulations	Kaufmann *et al.* (2011)
	ruleoflaw	A -2.5 to 2.5 *rule of law* index that 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	Kaufmann *et al.* (2011)

Type of Variables	Variable label	Definition	Data Source
	voiceaccount	A -2.5 to 2.5 index on *voice and accountability* that captures the extent to which citizens can participate in government selection procedures and have freedom of expression and association	Kaufmann *et al.* (2011)
	contcorrupt	A -2.5 to 2.5 index measuring *control of corruption* that 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	Kaufmann *et al.* (2011)
	polstability	A -2.5 to 2.5 index of *political stability* that captures perceptions on the likelihood that governments become destabilized or overthrown by unconstitutional or violent means	Kaufmann *et al.* (2011)
	goveffective	A -2.5 to 2.5 index of *government effectiveness* that captures the quality of public services and policy formulation, as well as the degree of government commitment to policies.	Kaufmann *et al.* (2011)
Population	logpopulation	Log of population size	WDI (2011)
Level of education	tertiaryed	School enrollment, % of population with tertiary education	WDI (2011)

APPENDIX 4: DESCRIPTIVE STATISTICS

Variable label	No of observations	Mean	Standard Deviation	Min	Max
$\log A^c$	199	2.585	2.594	-5.409	8.290
$\log A^d$	142	2.429	2.234	-3.285	7.655
$\log A^{TOT}$	215	3.328	2.218	-4.280	8.376
A^d/A^c	137	4.000	5.200	0.005	43.823
logtotalaid	264	7.472	1.315	4.667	10.372
logCO2pc	242	-5.973	0.334	-6.591	-5.199
environexpen	172	0.512	0.330	-0.458	1.617
loggdppc	264	10.393	0.205	9.743	10.933
leftgov	251	1.956	0.935	1.000	3.000
democracy	264	9.841	0.498	8.000	10.000
ruleoflaw	220	1.503	0.379	0.313	1.964
regulquality	210	1.402	0.317	0.537	2.012
voiceaccount	220	1.345	0.254	0.609	1.827
contcorrupt	220	1.634	0.587	0.156	2.467
polstability	220	0.927	0.371	-0.180	1.577
goveffective	220	1.592	0.426	0.316	2.237
tertiaryed	241	0.644	0.138	0.353	1.039
logpopulation	264	16.776	1.213	15.127	19.542
kyotoprot	264	0.417	0.494	0.000	1.000

APPENDIX 5: CORRELATION MATRIX

	$\log A^c$	$\log A^d$	A^d/A^c	$\log A^{TOT}$	logCO2pc	loggdppc	environexpen	kyotoprot	leftgov	logtotalaid	tertiaryed	democracy	logpopulation	regulquality	ruleoflaw	voiceaccount	contcorrupt	polstability	goveffective
$\log A^c$	1.000																		
$\log A^d$	0.870	1.000																	
A^d/A^c	-0.374	0.870	1.000																
$\log A^{TOT}$	0.916	0.827	-0.281	1.000															
logCO2pc	0.105	0.054	-0.026	0.168	1.000														
loggdppc	0.334	0.381	-0.189	0.303	0.249	1.000													
environexpen	0.014	0.109	0.075	-0.125	0.211	0.161	1.000												
kyotoprot	0.163	0.287	-0.031	0.233	-0.021	0.287	0.083	1.000											
leftgov	-0.147	-0.133	0.102	-0.159	-0.145	-0.198	0.044	-0.151	1.000										
logtotalaid	0.669	0.665	-0.175	0.657	0.249	0.505	-0.144	0.171	-0.167	1.000									
tertiaryed	-0.025	-0.068	0.042	0.054	0.367	0.004	-0.056	0.307	-0.036	-0.077	1.000								
democracy	-0.098	-0.712	0.065	-0.108	0.105	0.351	0.218	-0.054	0.083	0.076	-0.268	1.000							
logpopulation	0.423	0.423	-0.114	0.419	0.291	-0.058	-0.290	0.017	-0.103	0.711	0.006	-0.203	1.000						
regulquality	-0.015	-0.049	0.066	0.001	0.231	0.428	0.425	0.011	0.147	0.092	0.042	0.286	-0.323	1.000					
ruleoflaw	0.136	0.118	-0.019	0.100	0.157	0.547	0.235	-0.011	0.082	0.134	-0.013	0.346	-0.403	0.840	1.000				
voiceaccount	-0.064	-0.092	0.073	-0.053	0.038	0.472	0.155	-0.059	0.127	-0.024	-0.094	0.501	-0.544	0.777	0.786	1.000			
contcorrupt	0.075	0.063	0.039	0.073	0.110	0.477	0.197	-0.071	0.155	0.103	-0.027	0.433	-0.415	0.875	0.936	0.858	1.000		
polstability	-0.070	-0.113	0.103	-0.092	-0.060	0.259	0.203	-0.219	0.109	-0.213	-0.191	0.425	-0.613	0.494	0.656	0.654	0.667	1.000	
goveffective	0.052	-0.004	0.016	0.032	0.174	0.493	0.165	-0.165	0.025	0.135	-0.001	0.300	-0.376	0.821	0.896	0.796	0.897	0.634	1.000

Note: the shaded area in the table shows the correlation matrix across the institutional variables