Donor accountability reconsidered: aid allocation in the age of global public goods

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Abstract

Development assistance is increasingly used to fund the provision of global public goods. This has implications for the assessment of the donors' motivation for the provision of these funds. Given the non-excludability characteristic of global public goods, the traditional classification of donor interests and recipient needs is not appropriate for analyzing donors' aid allocation decisions. Funding for the provision of global public goods should not flow to those places with the greatest needs—as assumed by the existing aid allocation literature—but to those where they can be provided most efficiently. After explaining the theoretical rationale behind this claim, we empirically show its implication at the example of aid for climate change mitigation (a global public good). While the control for efficiency-related variables can solve the attribution problem for individual public goods, it is difficult to conceive of appropriate controls at the aggregate level. This represents a major challenge for the aid allocation literature and implies that holding donors accountable for their overall aid portfolio will become more difficult in the future.

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1. Introduction

Decades of scholarly literature have held donor governments accountable by assessing whether the allocation of foreign aid followed recipient needs and merits, or rather the direct commercial or geopolitical interests of the donors themselves. In terms of the development impact, the former has been shown to be clearly more effective than the latter (Kilby and Dreher 2010, Dreher et al. 2018a). However, the increasing relevance of global public goods for development—as exemplified by the adoption of the Sustainable Development Goals (SDGs) in September 2015—considerably challenges the traditional classifications as measures of accountability.

In this paper, we will theoretically show why this is the case: When development assistance addresses global public goods, the characteristics of the recipient, i.e. the country in which the funds are invested, can no more be considered to be a relevant proxy for the needs orientation of the donor. Even if there are some local side-benefits, the primary effect is of global nature, and as a consequence, other countries may benefit much more than the recipient itself.

For example, to combat malaria in poor Sahel countries, it may be more effective to support an existing center of medical research in Thailand's capital Bangkok than to establish a new center in rural Burkina Faso or Mali. These two countries will benefit most when a cure is developed fast, no matter where this happens. Similarly, a country like Bangladesh that is in urgent need of climate change mitigation to preserve the most fertile and populated of its land will benefit most if available funding is invested efficiently (i.e., where it will achieve the greatest emission reductions), which may be in China rather than in Bangladesh itself. In short: global public goods drive a wedge between the project location on the one hand and the locations where the benefits accrue on the other. This challenges the very basis of the aid allocation literature.

The special characteristics of global public goods and the implications for their funding by foreign aid started to be discussed in the late 1990s (Kaul et al. 1999; Jayaraman and Kanbur 1999; Kaul et al. 2003; te Velde et al. 2002, 2006; Sandler and Arce 2007; Kaul 2014), but the aid allocation literature has not built on this knowledge so far. There may be different reasons for this. First, until recently, the provision of global (as opposed to national) public goods through international development assistance has been a relatively limited phenomenon (Sandler and Arce 2007: 530f.). Second, available data were scarce (Cook and Sachs 1999: 442) and unreliable (Michaelowa and Michaelowa 2011: 2012).

Both factors are starting to change. The most recent research highlights the growing trend in development assistance for global public goods. Cepparulo and Giuriato (2016) estimate that by 2013, up to 19 per cent of bilateral aid was targeted towards global public goods, with strong variations between donors. Davies (2015) assesses

that about a quarter of bilateral and half of multilateral aid flows are aimed to finance either global public goods or complementary goods that are required for their provision. For the specific case of health-related assistance, Schäferhoff et al. (2016) estimate that 14 per cent of aid and research and development funding goes to global public goods rather than country-specific needs.

At the political level, the SDGs explicitly highlight the global connection between all countries. About half of the 17 goals directly address global or at least regional public goods in their specific targets (climate change, biodiversity, infectious diseases, peace and security, global macroeconomic stability and the like). With the SDGs as the new reference for development assistance since 2015, future aid should increasingly be oriented towards transnational public goods, for which the traditional categories of the aid allocation literature do not make much sense.

What does this imply for donors? They should provide aid for global public goods based on new and different criteria related to the question where these goods can be produced most efficiently, to the benefit of all. Hence, rather than to examine where they are needed most, donors need to examine where these goods can best be produced. It is not clear to what extent this consideration has entered into their decision-making process yet. However, if donors adjust their aid allocation principles accordingly, they may be misinterpreted as being self-interested while they are simply being efficient. In many cases, this is what the traditional—and ill-fitting—aid allocation literature would conclude.

We use the example of aid for the mitigation of climate change ('mitigation aid') to illustrate our case. This is an area in which substantial aid has been invested even before the adoption of the SDGs. To identify donor contributions in this field, the Development Assistance Committee (DAC) of the Organisation for Economic Cooperation and Development (OECD) especially introduced the so-called 'Rio markers' (referring to the United Nations Conference on Environment and Development in Rio—the 'Rio Summit'—in 1992). Mitigation aid is assistance to developing countries to avoid or reduce greenhouse gas emissions. It addresses the global public good of preventing dangerous climate change. We will thus focus on mitigation aid in our empirical example. In this context, we will examine whether donors effectively follow different criteria for mitigation aid allocation and other aid, and what this implies for the potential misinterpretation of the donors' motivation along the lines of the traditional aid allocation theory.

The remainder of the paper is structured as follows: Section 2 provides a brief overview of the extant aid allocation literature. Section 3 then explains why the conceptual idea this literature relies on cannot be extended to aid for global public goods. On the basis of this discussion, we derive some criteria that should drive effective aid allocation for mitigation in Section 4. This theoretical rationale is

compared to the empirical evidence on donors' mitigation aid allocation in Section 5. Finally, Section 6 draws some conclusions for donor accountability, for the budgeting of financial support for global public goods, and for the future orientation of the aid allocation literature.

2. The aid allocation literature

The aid allocation literature has been a vast and fertile field of research questioning and assessing the motives of donors' contributions since the early 1970s (e.g., Abott, 1970: 1216). Holding donors accountable for their motives is relevant as these motives are crucial for the effectiveness of aid. When aid is allocated based on donor interest (e.g., for geopolitical or commercial reasons), rather than based on recipient need, this must be expected to reduce the effect aid could otherwise have on its generally supposed primary goal, namely economic development and the reduction of poverty in the world. Kilby and Dreher (2010), as well as Dreher et al. (2018a) provide clear empirical evidence that indeed, aid allocated based on donor interest is less effective.

McKinley (1978) and McKinley and Little (1977, 1979) were the first to establish the theoretical distinction between a donor interest and a recipient need model of aid allocation, and to econometrically assess bilateral donors' aid allocation along these lines. Maizels and Nissanke (1984), Frey and Schneider (1986), Grilli and Riess (1992) and Neumayer (2003) extended the analysis to multilateral donors. A comprehensive review of the aid allocation literature until the mid-2000s is provided by Doucouliagos and Paldam (2009) who find that across the studies, GDP per capita—the central indicator of recipient need—has a very robust effect, but this effect is small leaving ample room for a variety of other motives. Generally, most studies find evidence for both donor interest and recipient need, to varying extents depending on the donor and on the period observed (with less geopolitical motives after the end of the Cold War).

More recent studies have confirmed the earlier findings using improved econometric estimation techniques that reflect the two-or even three-dimensional panel structure of the data as well as censoring (no negative aid can be observed) and selection effects (e.g., Gang and Lehmann 1990; Trumbull and Wall 1994; Berthélemy and Tichit, 2004; Berthélemy 2006).

Since the mid-2000s, a special strand of the literature has focused on aid allocation to reward or encourage donor-friendly voting in the United Nations General Assembly (Dreher et al. 2008; Dreher and Sturm 2012; Carter and Stone, 2015) or during temporary membership in the United Nations Security Council (Voeten 2001; Lai and Morey 2006; Kuziemko and Werker 2006; Eldar 2008; Dreher et al. 2009). Other scholars have also examined how multilateral donors' aid allocation was influenced

by important member countries, notably board members (Andersen et al. 2006; Fleck and Kilby 2006a; Kilby 2006; Kaja and Werker 2010). Some studies also focus on the influence of domestic politics, economic interests and lobbying in the donor country (Anwar and Michaelowa 2006; Fleck and Kilby 2006b; Tingley 2010; Dreher et al. 2015; McLean 2015; Dietrich 2016). Another strand of the literature analyzes the so-called "new donors" like China or India and examine how their aid allocation differs from the one by more traditional donors (Dreher et al. 2011; Fuchs and Vadlamannati 2013; Dreher and Fuchs 2015; Dreher et al. 2018b; Humphrey and Michaelowa 2019). More recently, Bermeo (2017) argues that in an increasingly interconnected world, donors have begun targeting aid to those developing countries from which the negative spillovers of underdevelopment are affecting them. She therefore claims that promoting development in thus targeted poor countries is itself a new form of donor interest.

The only major conceptual innovation regarding the basic donor interest versus recipient need model was introduced in the early 2000s. This is when aid allocation studies started to add a third conceptual category, namely recipient merit, meant to capture the quality of a recipient's economic and/or political governance and stability. Driven by Burnside and Dollar's (2000) plausible argument that aid should be more effective in countries with good politics, the traditional variables in the aid allocation equation did not seem sufficient any more. A well-meaning, purely development-oriented donor might, after all, not allocate aid to certain poor countries—simply because their bad governance or instability would make it implausible that the funds would be used productively. Leaving out the relevant governance variable(s) may hence affect the coefficient estimates for the recipient need and donor interest related variables. This, in turn, could generate an omitted variable bias. Alesina and Dollar (2000) were the first to include indicators of governance in their study of aid allocation, and were followed by many others later (e.g., Epstein and Gang 2009; Dietrich 2013). Chauvet (2003) is another example looking specifically at instability. Hoeffler and Outram (2011) estimate the relative importance of recipient merit (as compared to recipient need and donor interest) for the aid allocation by different donors.

Among the various developments of the aid allocation literature over time, the conceptual addition of recipient merit as a third category providing an additional motive in line with 'good donorship' is the most important one in the context of our own analysis. Our intention is similar in two ways: First, we believe that with the increasing emergence of aid for global public goods (GPG aid), yet another category is required in order not to misinterpret donors' motives for aid allocation. Second, just as for aid allocated in response to recipient merit, donors' intention to invest aid where it can be used most efficiently could be misunderstood as a lack of orientation towards recipient needs if such a new category is not included in the models.

Unfortunately, however, as opposed to the existing categories of recipient need, donor interest, and also recipient merit, it is difficult to conceive of any single (i.e., homogeneous) category that would capture the efficient aid allocation for global public goods. While it seems possible to find indicators for the efficient allocation of resources for the contribution to specific public goods (see, e.g., Steele 2017 for the case of infectious diseases), common indicators for the efficient provision of goods as diverse as climate change mitigation, curing and/or limiting the spread of Ebola, or establishing global macroeconomic stability, will be hard to find. This represents the key challenge that the aid allocation literature will have to face in the age of global public goods.

3. The theoretical problem

3.1. The significance of project location for GPG aid

By definition pure public goods fulfill two criteria: their benefits are non-excludable, and their use is non-rival. Once the good is available, everyone can benefit from it, and the fact that additional persons benefit does not diminish the benefits for anyone. Sometimes these effects appear locally, such as in the case of a dam. Everyone living behind the dam is protected, and the protection of one family is not reduced due to the additional protection of others. When non-excludability and non-rivalry are global in nature, we speak of global public goods (GPGs).[1]

Whenever we have non-excludability across the borders of individual countries, recording the benefits only for the country in which the good is produced is misleading. In fact, the neighboring country may benefit even more. Take the protection from infectious diseases as an example. Imagine a relatively well-off country in which the disease starts first and a poor neighboring country to which it would spread sooner or later. The effects could be much worse in the second country than in the first due to adverse hygienic conditions and poor access to medication. If the first country develops a vaccine, this may hence have an even greater positive effect on the neighboring country than on itself. If the vaccination campaign were an aid project, the medical needs of the first country would obviously be an inappropriate indicator for recipient need despite the fact that this is where the intervention took place.

The example demonstrates the problem, although it does not even discuss a pure public good: the neighbor of a vaccinated person is not as fully protected as the

[1] See Kaul et al. (1999, 2003) and Morrissey et al. (2002) for an in-depth conceptual discussion of the definition of public goods, and Sandler and Arce (2007) for a detailed classification of public goods in terms of their geographical scope.

vaccinated person him- or herself, and hence we would rather speak of positive externalities or spillover effects. However, when externalities are substantial, our arguments apply in a similar way. To simplify, we will hence use the term "public good" in all such cases (and the term "global public good" whenever these externalities are of a broad international dimension). Pure public goods are rare, but there are numerous goods with substantial regional or global externalities, and many of them have been already mentioned above in the context of the SDGs.

Due to their global nature, the benefits of GPGs do not directly depend on where they are provided. Yet, the locality matters. Donors funding the provision of GPGs in any random developing countries will not be allocating their aid efficiently. This is because the volume of GPGs that can be provided at a given cost varies substantially between localities. A good donor should hence pick a location that maximizes the volume of GPGs produced. Only in rare cases this locality will correspond to the locality that will reap the greatest benefits.

As a consequence, good donorship cannot be measured in terms of whether the aid flows to those recipients who are in greatest need. It should be measured in terms of whether the recipient can be expected to be an efficient provider of the GPG. In the next subsection, we outline two prototypical types of donors that could be conceptualized with respect to how they behave in terms of the provision of GPG aid.

3.2 Ideal donor types based on motives for the provision of GPG aid

In analogy to the donor categories that Berthélemy (2006) proposed for general development aid, we define ideal donor types depending on their motives with respect to the provision of GPG aid. Note that in practice, these motives may be mixed.

A. Careless donors—These donors do not differentiate their aid allocation depending on its purpose and may not have spent much effort in considering where their GPG aid would be most effective. Or they may face incentives that prevent the reconsideration of funding criteria in this case (Namhata 2018). Their aid allocation would hence follow very similar criteria irrespective of whether we analyze GPG or non-GPG aid. Consider the example discussed in the section above. If the donor invested their aid money for developing a vaccine on the basis of the stronger medical needs of the poorer country, but without taking into account where such a vaccine could be developed more easily, they would be considered to be careless.

B. Efficient but misinterpreted—These are donors who incorporate efficiency criteria in their GPG aid allocation decisions but may be misinterpreted when they do so. They allocate their aid not merely on the basis of recipient needs, but rather on the basis of where the maximum amount of GPGs would be produced cost-effectively. Again, we consider the aforementioned example. Giving the aid to the comparatively rich country would make sense given its stronger ability to cost-effectively produce the

vaccine thanks to better research capacity. The decision to allocate aid on the basis of efficiency may ultimately help their poor neighboring country more by allowing a faster development of the vaccine. However, it raises the risk that the donor could be misinterpreted by the traditional aid allocation literature: Their aid to the richer country rather than the poorer one might be considered to reflect donor interests since these middle-income countries are generally geo-strategically or commercially more important to donors.

Our contention, hence, is that in the case of global public goods, good donorship cannot be measured in terms of whether the aid flows to those recipients who are in greatest need. It needs to be measured in terms of whether the recipient can be expected to be an efficient provider of the GPG. As mentioned above, this measure will typically depend on the specific GPG concerned. This prevents an easy fix for the general aid allocation literature and will thus make it more difficult to use this approach to hold donors accountable.[2]

What is possible, however, is to introduce criteria for the efficient provision of specific GPGs. We present an empirical example of such a case in the next section.

4. Empirical application: the case of mitigation aid

In the previous section, we discussed that in the age of GPGs, it is getting more and more difficult to hold donors accountable for their decisions since efficient production of every GPG will require unique efficiency criteria. When focusing on a specific GPG, however, it is possible to introduce such efficiency criteria into the empirical analysis. This allows us to demonstrate the theoretical problem at the example of aid for the mitigation of climate change. Mitigation aid is a case for which we have data, and where we can define specific criteria that account—at least partially—for efficiency in the provision of this public good.

The reduction of greenhouse gas emissions in order to mitigate climate change is an example of the provision of a public good that is truly global in nature. A given amount of emission reductions will have the same effect on, say, agricultural production in Uganda, no matter where the mitigation takes place. Different countries benefit to varying extents, depending on their vulnerability to the impacts of climate change. This vulnerability may, in turn, be related to topographical as well as economic

[2] It may be worthwhile to note that the non-excludable character of the benefits of GPGs affects the measurement of donor accountability in yet another way. It prevents state-of-the-art evaluations because, by definition, there is no control group that has not been contaminated by the effects of the intervention (Jimenez and Chomniz 2015).

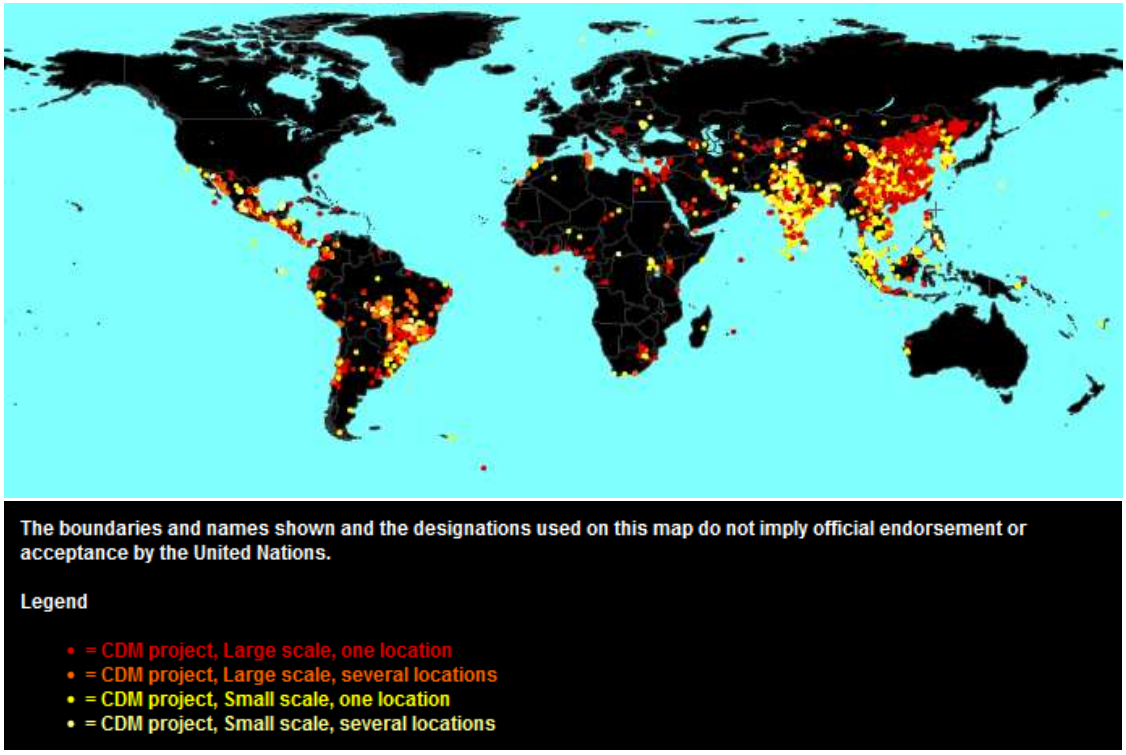
characteristics (e.g., the elevation above sea level or the dependency on agricultural production).

Mitigation aid is defined as financial assistance to developing countries to avoid or reduce greenhouse gas emissions. Since it is a form of GPG aid, as discussed above, funding should go where it can be used most efficiently, i.e., where a given amount of finance can produce the greatest emission reductions.

Efficiency in terms of climate change mitigation is negatively, rather than positively correlated to poverty in developing countries. Indeed, the greatest potential for relatively low-cost emission reductions lies in emerging economies. Very poor countries usually have few emissions as they do not have much industry and no emissions-intensive consumption. Hence, opportunities for large-scale reductions are scarce in these countries. When countries experience economic growth and a broader middle class starts to develop, things usually begin to change. The population's lifestyle becomes much more emissions-intensive, there are large infrastructure development projects, and transportation in private cars becomes an issue. At the same time, industrial production and energy provision are often still very inefficient (see Michaelowa and Michaelowa 2009 for a more detailed discussion of such emissions paths). This provides ample opportunities for emission reduction projects.

These opportunities have also become apparent from the development of the market for tradable 'certified emission reductions' (CERs) under the 'Clean Development Mechanism' (CDM) of the Kyoto Protocol. This market allowed project developers in developing countries to sell emission reduction credits to firms and governments of developed countries who could then make use of these CERs to comply with their emission reduction commitments in the framework of the Kyoto Protocol. Figure 1 provides a snapshot of the distribution of these CDM projects. The figure clearly confirms that the most efficient locations for emission reductions have been in the more advanced developing or emerging economies, notably in China, India and Brazil, rather than in the poorest countries.

Figure 1: Distribution of registered CDM projects



Source: UNFCCC (2016).

As a consequence, an efficiency-oriented donor should indeed prefer to direct mitigation aid to China, rather than to Bangladesh, because the opportunities for efficient emissions reductions are much greater in the former (see also Jayaraman and Kanbur 1999: 429). For a given volume of aid, the investment in China will lead to higher emission reductions and hence, eventually, to greater benefits for Bangladesh—one of the countries most vulnerable to climate change.

In practice, there is some anecdotal evidence that donors have started considering specific efficiency criteria for mitigation projects. Buchner et al. (2012) describe several project monitoring and evaluation frameworks that frequently include considerations of projects' emissions reduction potential and cost-effectiveness as evaluation criteria.

As explained above, however, the traditional aid allocation literature would misinterpret efficiency-oriented donors, since emerging economies such as China are also more important to donors for geopolitical and trade-related reasons. To avoid this misleading conclusion, we must find appropriate indicators to control for the effectiveness of GPG provision. In the case of mitigation aid, such indicators should reflect CO_2 emissions, the predominance of dirty industries, and the like. Alternatively, we can follow the above argument that the private market tends to find the efficient opportunities most easily so that the CERs issued in the context of the CDM (or other

CDM-related variables) could provide us with a second measure for countries with a high emission reduction potential. In the following section, we will examine how the allocation of mitigation aid would be assessed under the traditional aid allocation framework, compared to our proposed inclusion of efficiency criteria.

5. Re-interpreting the empirical evidence

5.1 Empirical approach

In the following, we will examine the allocation of mitigation aid using a three-dimensional panel dataset with the dimensions time, recipient and donor.[3] We compare a traditional aid allocation model based on the usual covariates for recipient need, recipient merit and donor interest, to a model that also includes additional controls for recipient countries' mitigation efficiency. Eventually, we assess and compare individual donor behavior.

If a donor is aware of where climate change mitigation can be provided most efficiently, and allocates funding accordingly, then their mitigation aid should exhibit a positive correlation with the recipient countries' GDP per capita, in contrast to what we should expect for traditional development aid. In other words, efficiency-oriented donors should exhibit a positive, rather than negative correlation between mitigation aid and the recipients' GDP per capita.

Donors might however care for both, mitigation efficiency and local development improvements. Typical mitigation-related investments can have sizable local co-benefits for the recipient country, such as job creation and infrastructural improvements including increased (clean) energy provision (for a review, see Karlsson et al. 2020). In this case, we may see that mitigation aid provision is still negatively correlated with recipients' GDP per capita. However, if the donors care to some extent about mitigation efficiency, the coefficient should at least be less negative than in the case of other traditional (non-GPG) aid. In the traditional aid allocation framework, this would be wrongly interpreted as a lack of poverty orientation.

In addition, the allocation of mitigation aid may be positively correlated with donor interest variables such as exports, foreign direct investment, or indicators of geopolitical relevance, even if this is merely (or primarily) a reflection of efficiency orientation. In other words, efficient donors may be perceived as more selfish than they actually are.

[3] For preliminary work that examines aid allocation aggregated over all bilateral donors, see Bagchi et al. (2016). In this preliminary study, we also compare aid for climate change mitigation to aid for climate change adaptation. This allows us to show the contrast between the geographical allocation of GPG and non-GPG aid within the area of climate policy.

However, for efficiency-oriented donors, the perceived lack of poverty orientation and selfishness should disappear once mitigation efficiency is appropriately controlled for. Since our efficiency indicators are only imperfect proxies of actual efficiency, these effects may not completely vanish but should at least become smaller.

In contrast to efficiency-oriented donors, careless donors do not consider the different logic of efficient aid allocation in the context of GPGs and hence show no difference in their aid allocation to mitigation and other purposes. In the traditional aid allocation model, they would (wrongly) seem to be the better donors.

Our results will allow us to understand which individual donors are predominantly careless and which ones are rather efficient but misinterpreted. Of course, donors may make compromises, and include some efficiency consideration without moving too far away from their standard aid allocation pattern. This may happen, for instance, when donor agencies understand that the allocation of mitigation aid should follow different criteria, but face political pressure to show that all their development assistance is spent in very poor countries (Namhata 2018). More generally, the geographical allocation of aid may be a political equilibrium carefully balancing the lobbying activities of different stakeholders like NGOs and private companies, and a donor agency may find it difficult to deviate from this equilibrium. While we will not investigate the reasons for such behavior, we will demonstrate the variation among donors in the degree to which they adjust their criteria for the allocation of mitigation aid.

5.2 Data

We use OECD/DAC data on official development assistance (ODA) for the purpose of climate change mitigation for our dependent variable. In line with the aid allocation literature, we use aid commitments rather than disbursements because commitments reflect the donors' intent better than disbursements (while eventual disbursements can depend, e.g., on absorption problems on the recipient side). Mitigation aid volumes are identified on the basis of a 'Rio marker' introduced by the DAC in 1998. Our overall dataset comprises 24 bilateral donors, over 130 recipients, and mitigation aid related data for 16 years (from 2002 to 2017). In line with most of the literature, we aggregate the information for individual years into broader periods, to reduce statistical noise and to acknowledge that donors take into account the information over several years to make their decisions. As our data cover 16 years, we regroup them into four periods of four years.

The Rio markers are available for projects with mitigation being the main focus of the respective activities ('principal objective'), and for projects within which mitigation is just a significant activity (among others). We only selected projects with mitigation as

their principal objective, because an equally relevant (or even more relevant) focus on other objectives would dilute the GPG character of the projects concerned.

As the reliability of the Rio markers was questionable in the initial years of their introduction (Michaelowa and Michaelowa 2011), we first reassessed the quality of the corresponding data. Our random draw and independent coding of 1000 aid projects now shows that the share of false positives was reduced to about 10%. While some noise remains, we consider that this is an acceptable basis for our empirical analysis.

We include two categories of explanatory variables, as outlined below. Further details, including descriptive statistics and data sources, are available in the appendix (Table A1).

A. *Traditional aid allocation variables*—The first group of variables comprises the typical regressors used in the aid allocation literature. We use GDP per capita as our main variable for recipient need. We also include a measure for population of the recipient countries since ceteris paribus, larger countries require more support. For recipient merit, we use the Freedom House Index (reversed scale, so that higher numbers indicate greater freedom) with missing values imputed using the Polity measure of level of democracy. In addition, we use an indicator of political stability. As indicators of donor interest, we include donor exports to recipients, foreign direct investment (FDI) flows from the donor to the recipient[4], and UN voting in line with the donors.

B. Variables to indicate mitigation efficiency—The second group of variables pertains to the measurement of mitigation efficiency. We define mitigation efficiency as being able to reduce the maximum amount of emissions with a given aid budget. We include two variables to directly measure the availability of emission reduction opportunities, namely the recipient country's total primary energy consumption and the CO_2 emissions intensity of the economy (i.e. CO_2/GDP). We also include a variable reflecting certified emission reductions (CERs) related to CDM projects in a country in a given year as well as a dummy for the existence of a so-called 'designated national authority' (DNA). A DNA enables developing countries to benefit from the CDM and thereby signals the countries' own interest in hosting corresponding emission reduction projects. We further introduce an indicator for the periods in which the Kyoto Protocol was fully (2005-2012) and partly operational (2013 onwards) because CDM projects could not be registered before 2005, and because the demand for CERs fell significantly after the end of the Kyoto Protocol's first commitment period in 2012.

[4] Note that we replace all negative values (indicating dominant disinvestment) with zero, as we believe that the 'donor interest' logic of donors supporting investors with complementary aid flows does not hold for disinvestment.

In addition to these explanatory variables, in several of our models we include a variable for other development aid (i.e. total ODA minus mitigation aid) from the same donor to the same recipient. Including this variable allows us to interpret the results as a direct comparison between the donors' general geographic allocation of development assistance and their allocation of mitigation aid.

5.3 Estimation strategy

Our estimation strategy closely follows the established approach in the aid allocation literature. We apply a Tobit model because there are many periods without any flow of mitigation aid between individual donors and recipients, so that the aid variable is censored at zero. The three-dimensional panel allows us to include year and donor fixed effects in all models. Year fixed effects are essential as both mitigation aid and GDP per capita show a significant upward trend over the years, which would lead to a spurious correlation if omitted. Donor fixed effects ensure that any unobservable differences between the donors do not affect our estimation results. Similarly, recipient fixed effects could have been included to control for unobserved recipient characteristics. However, given the small number of time observations, a Tobit model with recipient fixed effects is likely to be biased due to an incidental parameters problem (Berthélemy 2006). In addition, we expect that some of the relevant variation that we want to measure is cross-country and could not be assessed if we used recipient fixed effects (see Dreher et al. 2011). Furthermore, variation across recipients is also theoretically more important especially for those variables that only change slowly over time (Bermeo, 2017).[5] We thus did not include recipient fixed effects, but only adjusted the model to similarities between observations of given recipients by clustering standard errors on this dimension. A number of other studies have used similar approaches (e.g., Berthélemy and Tichit 2004; Nunnenkamp and Thiele 2006). Equally in line with most of the literature, we lag the relevant explanatory variables by one period. The only control we do not lag is 'Other ODA' as it should also move with a one-period delay relative to the other variables.

With Tobit models, the question always arises whether to present coefficients or marginal effects for the observed outcome variable. Coefficients can be interpreted as the marginal effects with respect to the underlying latent variable, which is unobserved when aid commitments are zero. We believe that there is a useful interpretation of the latent variable as the donors' willingness to spend (which can also be negative). This willingness is precisely what we are interested in when assessing donor motives. We thus directly present the estimated coefficients.

[5] The same incidental parameters problem would arise if we decided to apply dyad (donor-recipient) fixed effects in the Tobit model.

5.4 Empirical results

Table 1 shows the results for our panel estimations for all donors combined. While Models 1-3 include only exports and UN voting alignment to indicate donor interest, Models 4-6 also include FDI. The two sets of models are kept apart, because the inclusion of FDI leads to a reduction in the number of observations by about 25%. In both cases, the first regression only includes the traditional aid allocation variables (Columns 1 and 4). The second regression adds a control for other development aid—thus allowing a direct comparison between mitigation aid and general ODA (Columns 2 and 5). The third regression further adds the specific variables to capture mitigation efficiency (Columns 3 and 6).

The standard aid allocation model in Columns 1 and 3 does not reveal any remarkable differences from the outcomes the literature typically finds for general development assistance. We find that mitigation aid is negatively correlated with the recipients' GDP per capita (meaning that on average, more mitigation aid flows to poorer countries), and positively correlated with recipients' population, political stability, democratic rights, donor exports (and FDI), and agreement in the UN.

Controlling for other ODA in Columns 2 and 5, however, allows us to see some differences. The strong and significant coefficient of this variable first shows that mitigation aid closely follows the allocation of other development assistance. Second, the fact that other ODA is held constant change the interpretation of the coefficients. In these models, significant coefficients on the remaining control variables imply that these factors are relevant for the allocation of mitigation aid in a different way than for development assistance more generally.

The coefficient for GDP per capita becomes insignificant suggesting that mitigation aid is neither more nor less directed towards poor countries than any other type of aid. However, most of the indicators for recipient merit and for donor interests remain clearly significant. Focusing on commercial interest, we see that the coefficients of both exports and FDI clearly remain positive. This implies that mitigation aid is more reactive to these variables than other types of aid. Within the traditional framework of aid allocation this would be interpreted as mitigation aid being somehow more strongly driven by donor interests than other aid.

When including controls for mitigation efficiency in Columns 3 and 6, we again observe some change in coefficients. Most strikingly, we see a strong decrease in the coefficient of GDP per capita that again turns negative and significant. Furthermore, the coefficients for exports and FDI also diminish in size, albeit only slightly so (especially for FDI).

Table 1: Determinants of mitigation aid, Tobit model

	(1) Base model I	(2) Base model II (controlled for other ODA)	(3) Full model	(4) Base model I	(5) Base model II (controlled for other ODA)	(6) Full model
	Models without FDI			Models with FDI		
GDP per capita (log)	-3.894***	-0.293	-1.461*	-4.280***	-0.154	-1.611*
	(0.00)	(0.56)	(0.06)	(0.00)	(0.75)	(0.07)
Population (log)	1.861***	0.802***	-0.485	1.378***	0.499**	-1.031
	(0.00)	(0.00)	(0.46)	(0.00)	(0.05)	(0.18)
Other ODA (log)		2.739***	2.717***		2.883***	2.871***
		(0.00)	(0.00)		(0.00)	(0.00)
Political stability	1.121*	2.058***	1.796***	1.018	2.052***	1.726***
	(0.08)	(0.00)	(0.00)	(0.15)	(0.00)	(0.00)
Democracy	0.573***	0.564***	0.402***	0.516***	0.578***	0.434***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Exports (log)	1.488**	0.434**	0.381**	1.456***	0.353***	0.291**
	(0.01)	(0.02)	(0.04)	(0.00)	(0.01)	(0.03)
FDI (log)				0.236***	0.138***	0.130***
				(0.00)	(0.00)	(0.00)
Agreement in the UN	8.776**	3.726	2.580	2.059	-2.769	-4.216
	(0.04)	(0.28)	(0.46)	(0.67)	(0.41)	(0.22)
Kyoto operational			2.564			-1.046
			(0.31)			(0.70)
DNA dummy			0.441			0.840
			(0.66)			(0.46)
CERs (log)			0.263***			0.242***
			(0.00)			(0.00)
Energy consumption (log)			0.738			0.995
			(0.23)			(0.17)
CO_2 intensity (log)			-0.183			-0.108
			(0.77)			(0.87)
Constant	-42.933***	-72.911***	-40.092**	-28.502***	-66.656***	-25.958
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.19)
Observations	9668	9668	9668	7448	7448	7448
Year FE	YES	YES	YES	YES	YES	YES
Donor FE	YES	YES	YES	YES	YES	YES
Number of clusters	137	137	137	137	137	137
Left-censored obs.	7485	7485	7485	5778	5778	5778
Pseudo R2	0.112	0.164	0.167	0.125	0.181	0.183
Log-likelihood	-11050	-10402	-10371	-8381	-7848	-7823

Note: Robust p-values in parentheses, *** p<0.01, ** p<0.05, * p<0.1

To interpret these results, it should be noted that the three variables GDP per capita, exports and FDI are highly correlated. In fact, the correlation coefficient between GDP per capita and exports is 30%, and between exports and FDI, it is even 50% (see appendix, Table A2). This suggests that the effects on either of these variables cannot be well distinguished from each other, and that the changes should be considered

jointly. In any case, all three shifts point in the direction that the perceived selfishness may be driven by efficiency concerns.

The efficiency controls themselves are highly correlated among each other, too. This may explain why only the CER variable is (individually) significant here. However, based on the Akaike information criterion (AIC), we decided to keep all these controls in the model.

Overall, the results so far correspond to our expectations. On the one hand, the average donors keeps orienting his allocation of mitigation aid toward the same recipients that receive the bulk of his general ODA. On the other hand, some differences do appear, and they let aid allocation for the GPG of mitigation appear more selfish. This is a misperception and can be largely explained by efficiency considerations. In other words, to the limited extent that donors adjust their aid allocation patterns in an efficient way, they may be wrongly blamed as bad donors.

How much are individual donors concerned by this issue? Which donors drive the efficiency-oriented adjustments we observe and may thus mistakenly be blamed for selfishness? To answer these questions we assess aid allocation by individual donors in two complementary ways. In both cases, we continue to focus on income, exports and FDI as the most central traditional indicators of recipient need and donor interest. First, following Berthélemy (2006), we define dummies for each donor and introduce an interaction term between these variables and the donor dummies. This allows us to obtain each donor's individual income, export, and FDI elasticities. When the corresponding coefficient estimates are high and significant, the specific donor allocates his mitigation aid to richer recipient countries, and/or to countries to which his exports and FDI are higher than what we observe for other ODA. In case this deviation from the norm is larger in the base model (without efficiency controls) than in the full model (with efficiency controls), it can—at least partially—be explained by efficiency concerns.

The elasticities obtained in this way (both for the base and for the full model) show each donor's deviation from a general norm. While it shows whether this donor's mitigation aid is more or less strongly correlated with income, exports and FDI than aid by other donors, this may also happen because a donor is generally more or less need- and interest-oriented than other donors. This consideration induces us to re-estimate the equations for each donor individually, rather than based on a common model with interaction terms for income, exports and FDI. In this setting, we can identify whether a donor allocates his mitigation aid differently from his own development aid more generally.

While this adds relevant complementary information, we believe that the first approach is more important from a normative perspective. In fact, those donors who

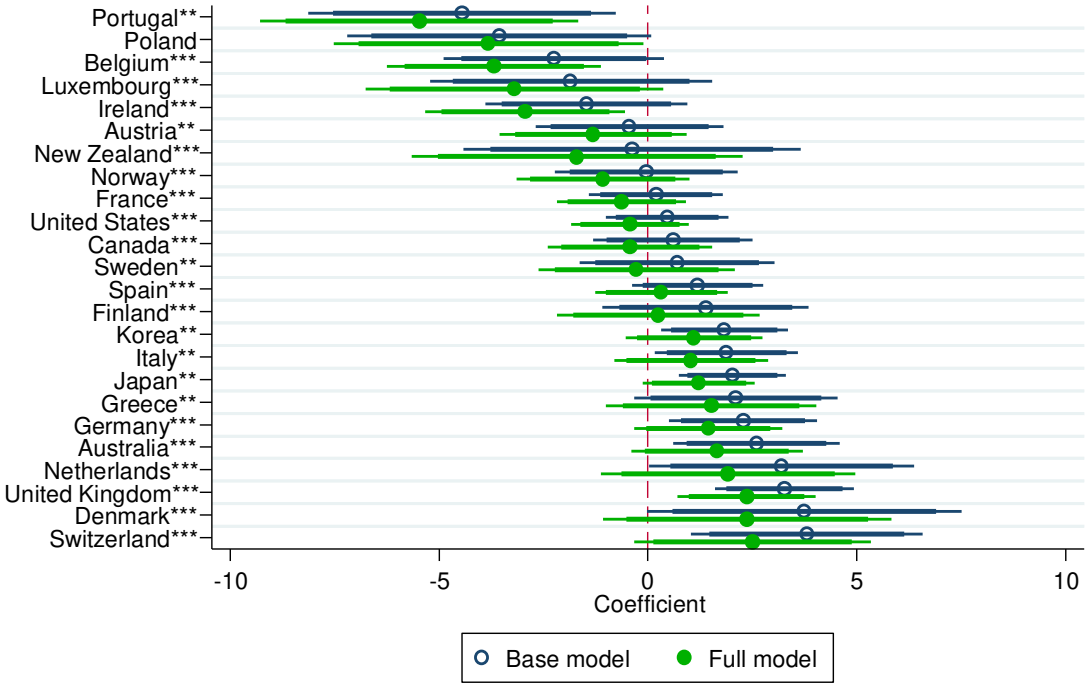
already spend all ODA in relatively wealthy countries (i.e., who are truly interest-oriented), may not actually need to spend mitigation aid differently to be efficient. These donors should spend their other ODA differently! The disadvantage of the second approach is that it cannot identify these kind of donors. We thus present the results of the first approach in the main text (Figures 1-3), and the results of the second approach in the appendix (Figures A1-A3).

Before doing so, let us consider another methodological issue. Given the problems with multicollinearity, when all three variables—GDP per capita, export and FDI—are included simultaneously in the regression analysis, one of the coefficient estimates may catch the relevant effect and the others may even move into different directions. Which of the coefficients reacts in which way can differ from donor to donor. For this reason, coefficients for the individual variables become difficult to compare across donors. We hence propose a simplification by estimating parsimonious models including only one of the three variables at a time. As additional controls (beyond the fixed effects) we include only other ODA (base model), and other ODA as well as the controls for mitigation efficiency (full model). This implies that the coefficient estimates we obtain for income, exports and FDI are always 'tainted' by the other two variables as far as these are correlated. At the same time, they will provide a better reflection of the overall shifts between careless continuation of spending along with general aid, and the reorientation of aid allocation for mitigation projects.

When considering the model for GDP per capita (Figure 1), a number of donors indeed seem to consider that mitigation aid should be allocated according to different criteria than other aid. Ten donors (Switzerland, Denmark, the United Kingdom, the Netherlands, Australia, Germany, Greece, Japan, Italy and South Korea) allocate mitigation aid to recipient countries that are significantly less poor than ODA recipients more generally (p-value=10%[6]). When controlling for efficiency variables, for most of the donors, this difference is no more significant Exceptions are the United Kingdom, Switzerland and Japan. In all these donor countries—including the latter three—the point estimate is significantly different (further to the left) in the full model as compared to the base model. This is indicated in the graph by the asterisks added to the country names. The results suggest that these countries may belong to the donors who are efficient, but would be misinterpreted in the standard recipient-need/donor-interest models.

[6] In the remainder of the discussion of results in this section, we will systematically refer to a p-value of 10% when considering significance.

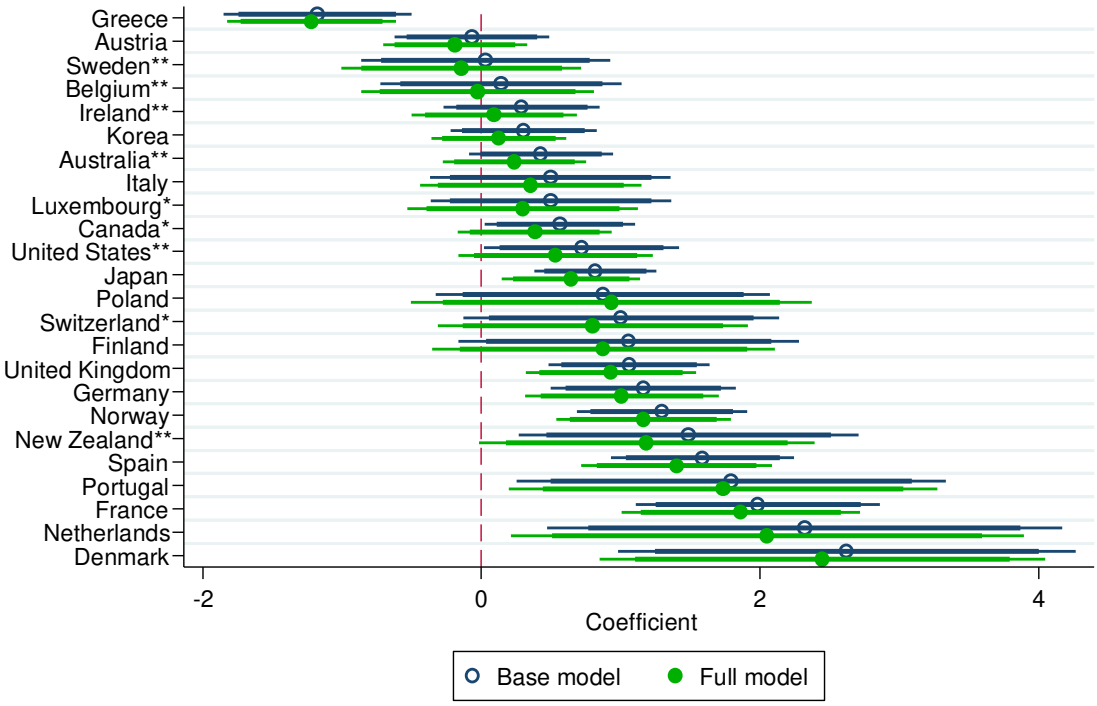
Figure 1: Income elasticity of mitigation aid, by donor country



Notes: Coefficient estimates presented here are based on interaction terms between donor dummies and recipient GDP per capita (logged) in a regression of mitigation aid (logged) controlling for donor and period fixed effects as well as other ODA (base model) and further controls for mitigation efficiency (full model). The confidence intervals (thick line 90%, thin line 95%) thus show the significance of the deviation from the international norm for other ODA. The asterisks following the country names show whether the difference of the coefficient estimates of the full model compared to those of the base model are significant (two-sided Wald test, robust p-values: *** p<0.01, ** p<0.05, * p<0.1).

Figure 2 presents the corresponding graph for export elasticities. Six of the ten donors mentioned above are again in the group for which the allocation of mitigation aid differs significantly from the typical allocation of other ODA. Along with these countries (Denmark, the Netherlands, Germany, the United Kingdom, Switzerland and Japan), another eight countries, namely France, Portugal, Spain, New Zealand, Norway, Finland, the United States and Canada also show a significantly stronger positive relationship between exports and mitigation aid. As before, the coefficient estimates of the full model show a smaller distance to the norm value. However, the difference between the full model and the base model is significant only for New Zealand, Switzerland, the United States and Canada. In three of these countries (Switzerland, the United States and Canada) as well as Finland, the estimated export elasticity in the full model becomes indistinguishable from the international norm. Results for exports are hence less clear than for income, but point in the same direction, with a large overlap of donors concerned.

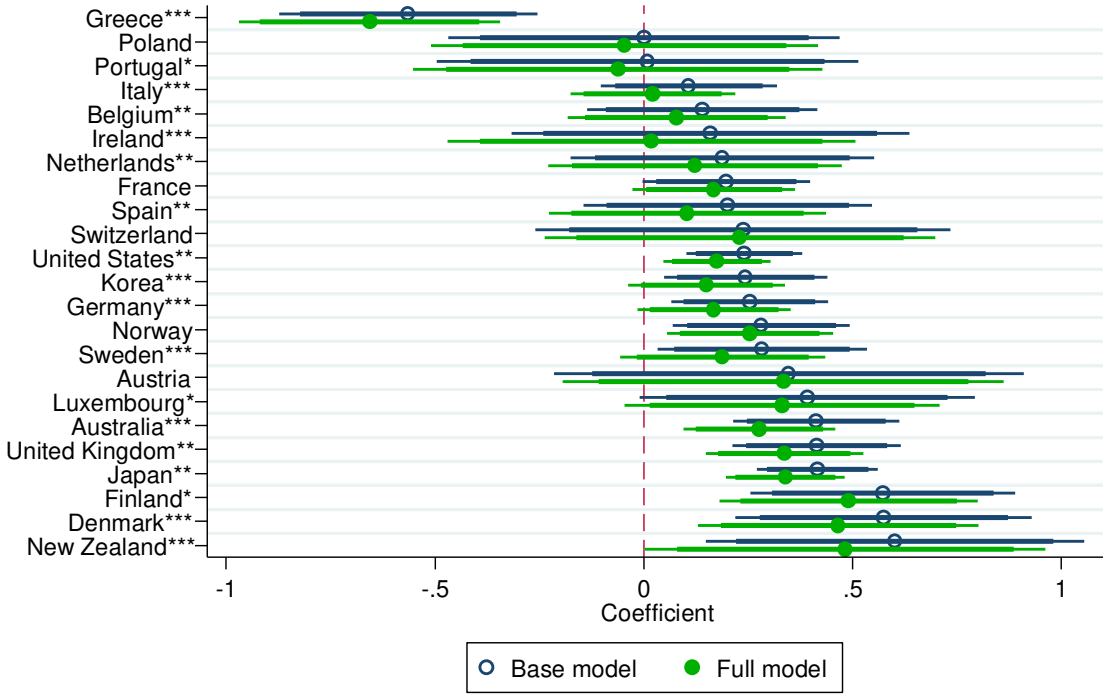
Figure 2: Export elasticity of mitigation aid, by donor country



Notes: Coefficient estimates presented here are based on interaction terms between donor dummies and exports (logged) in a regression of mitigation aid (logged) controlling for donor and period fixed effects as well as other ODA (base model) and further controls for mitigation efficiency (full model). The confidence intervals (thick line 90%, thin line 95%) thus show the significance of the deviation from the international norm for other ODA. The asterisks following the country names show whether the difference of the coefficient estimates of the full model compared to those of the base model are significant (two-sided Wald test, robust p-values: *** p<0.01, ** p<0.05, * p<0.1).

Figure 3 shows the corresponding results for FDI. The group of donors that could be classified as efficient and misinterpreted on this basis includes New Zealand, Denmark, Finland, Japan, the United Kingdom, Australia, Luxemburg, Sweden, Norway, Germany, South Korea, the United States and France. Again, the overlap with the previously mentioned sets of countries are large. Six out of these twelve countries have already been mentioned in the discussion of GDP per capita (Denmark, the United Kingdom, Australia, Germany, Japan and South Korea), and eight in the context of exports (Denmark, the United Kingdom, Germany, Japan, New Zealand, Norway, Finland, and the United States). Only in two cases, the inclusion of efficiency controls in the full model again leads to a reduction of the difference from the norm to the extent that the effect becomes insignificant (Sweden and South Korea). Yet, except for Norway, for all countries mentioned, the elasticity estimated in the base model is significantly greater than the elasticity measured in the full model.

Figure 3: FDI elasticity of mitigation aid, by donor country



Notes: Coefficient estimates presented here are based on interaction terms between donor dummies and FDI (logged) in a regression of mitigation aid (logged) controlling for donor and period fixed effects as well as other ODA (base model) and further controls for mitigation efficiency (full model). The confidence intervals (thick line 90%, thin line 95%) thus show the significance of the deviation from the international norm for other ODA. The asterisks following the country names show whether the difference of the coefficient estimates of the full model compared to those of the base model are significant (two-sided Wald test, robust p-values: *** p<0.01, ** p<0.05, * p<0.1).

Note that Denmark, Germany, Japan and the United Kingdom appear as efficient, but misinterpreted in all three settings (looking at income, exports as well as FDI). For both Denmark and Germany, the difference in coefficient estimates between the base and the full model are also significant at least once, and at least one of the coefficients for income, exports or FDI loses significance in the full model. For all four donors, verification in the appendix (Tables A1-A3) shows that when the allocation of mitigation aid is compared to the countries' own spending of other aid, there are similar differences that point at a distinct allocation pattern for mitigation aid. For Denmark, Germany, Japan and the United Kingdom the coefficient estimates of the base models for income, exports and FDI are significantly positive. In the full models, the coefficient estimates are often insignificant and, in any case, significantly different from those of the base model (except for the United Kingdom). We can further make out some differences within these four countries, with Denmark clearly ahead of the other three donors in terms of both the size of the coefficients in the base model, and the differences between base model and full model estimations.

Reversely, we observe a few donors that do not seem to react to the fact that mitigation is a GPG, no matter which perspective we adopt. Austria, Belgium, Ireland and Poland never show any significant difference from the typical allocation of general ODA in the direction that could indicate a consideration of efficiency concerns. They could thus be classified as careless donors. A verification of these results in Tables A1-A3 in the appendix confirms this classification, in particular for Poland where coefficients often move in the opposite direction of what should be expected for efficiency.

Table 2 provides an overview of the above results. Noticeably, the countries that appear as the leaders here are not the Nordic donors typically at the head of rankings regarding effective aid allocation. Some of them may be among those countries with strong constituencies fighting for a need-oriented allocation of all aid, and thereby rendering differentiation more difficult. Except for Denmark, these donors are in the intermediate group. At the lower end of the ranking, we find only small donors that may lack the resources to develop independent aid strategies for different sectors. They might also rely on a small and relatively fix set of partner countries for all of their development cooperation, thereby limiting the options for adjustments in aid flows to the nature of the projects.

Table 2: Donor classification

Classification	Donor countries
Efficient, but misinterpreted (seemingly not poverty, but export and FDI driven allocation)	Denmark (1/1), Germany (1/1), Japan (0/1), United Kingdom (0/1)
Mixed results (depending on the dimensions considered)	*Efficient according to two out of three dimensions* Australia (1/1), Finland (1/1), France (0/1), Netherlands (1/0), New Zealand (0/2), Norway (0/0), South Korea (1/1), Switzerland (1/1), United States (1/2) *Efficient according to one out of three dimensions* Canada (1/1), Greece (1/0), Italy (1/0), Luxemburg (0/1), Portugal (0/1), Spain (0/1), Sweden (1/1)
Careless (no observable consideration of specific allocation criteria for mitigation aid)	Austria, Belgium, Ireland, Poland

Notes: Based on results for the multi-donor models with interaction terms, evaluated at a p-value of p=10% (standard errors clustered at the recipient level). The three dimensions considered refer to model for income, exports and FDI respectively. Numbers in brackets provide complementary information on the plausibility that a donor is actually misinterpreted. The first number is an indicator variable taking the value of 1 if the coefficient that is significantly positive in the base model loses significance at least once in the full model including efficiency controls. The second number counts the equations (out of three) for which the coefficient estimate in the base model and the full model are significantly different using a two-sided Wald test.

6. Conclusion

This paper has demonstrated the conceptual and empirical problems that the traditional aid allocation literature will face when aid is increasingly spent for global public goods. Non-excludability drives a wedge between the location where the project is implemented, and the location where the benefits arise. Hence, to be effective, aid related to global public goods should not flow to places with the greatest needs, but to places where these needs can be served best through an efficient provision of the global public good. This creates a fundamental conceptual problem for the aid allocation literature, the related effort to hold donors accountable for their motives and, eventually, for the effectiveness of their aid.

The empirical problem can be (partially) solved when disaggregating aid and looking at specific global public goods for which concrete controls for effective aid allocation can be identified. We do so for the case of mitigation aid and obtain the following results:

While many donors do not seem to consider different allocation criteria for mitigation aid in comparison to other ODA, some donors clearly do so. The clear frontrunner is Denmark, followed by Germany, Japan and the United Kingdom. For all donors combined, we also find some differences in the right direction, but the correlation with the geographic allocation of other aid remains strong and significant. This leads to a less effective use of any given budget for mitigation aid.

Furthermore, those donors allocating their aid in line with efficiency criteria may be wrongly accused of allocating aid in their own interest, rather than with a focus on recipient need. The misunderstanding is based on an omitted variable bias that disappears (or shrinks) when available indicators accounting for mitigation efficiency are taken into account.

The example of mitigation aid thus illustrates that indeed, aid for global public goods does not follow the logic of the traditional aid allocation literature. Unless there are convincing control variables, this logic cannot be applied. Unfortunately, there are no homogeneous controls for the efficient location of projects providing different types of global public goods.

One could argue that, as a consequence, the aid allocation literature should simply become more disaggregated. This may not be the solution, however, as easily observable efficiency indicators may not exist in all areas. When aid includes more and more funding for global public goods, it will become more complex to hold donors accountable for their allocation of these funds.

Finally, this discussion may also raise the question whether financing global public goods should at all be accounted as aid (see also Kaul 2014). Development aid was

initially conceived as a contribution that should benefit a specific (set of) recipient(s), but not the world as a whole. If not for certain co-benefits, recipients should also have only very limited incentives to accept aid focusing on the provision of global public goods. Finally, from an efficiency perspective, it must be considered that some global public goods will be most efficiently provided in developed rather than in developing countries. Will their provision be accounted for as development assistance when they are (inefficiently) produced in developing countries instead? Should the definition of development assistance perhaps depend on who benefits most, rather than on where the project is implemented? Or should the funding for global public goods generally not be considered as aid, but come out of a separate budget (as widely requested for climate finance, notably by developing countries)?

These questions highlight the challenges that arise for the statistical classification of development assistance at the level of the OECD/DAC. Meeting these challenges in an appropriate way will represent an important contribution to donor accountability and the effective allocation of development finance in the age of global public goods.

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Appendix

Table A1: Variable descriptions and sources

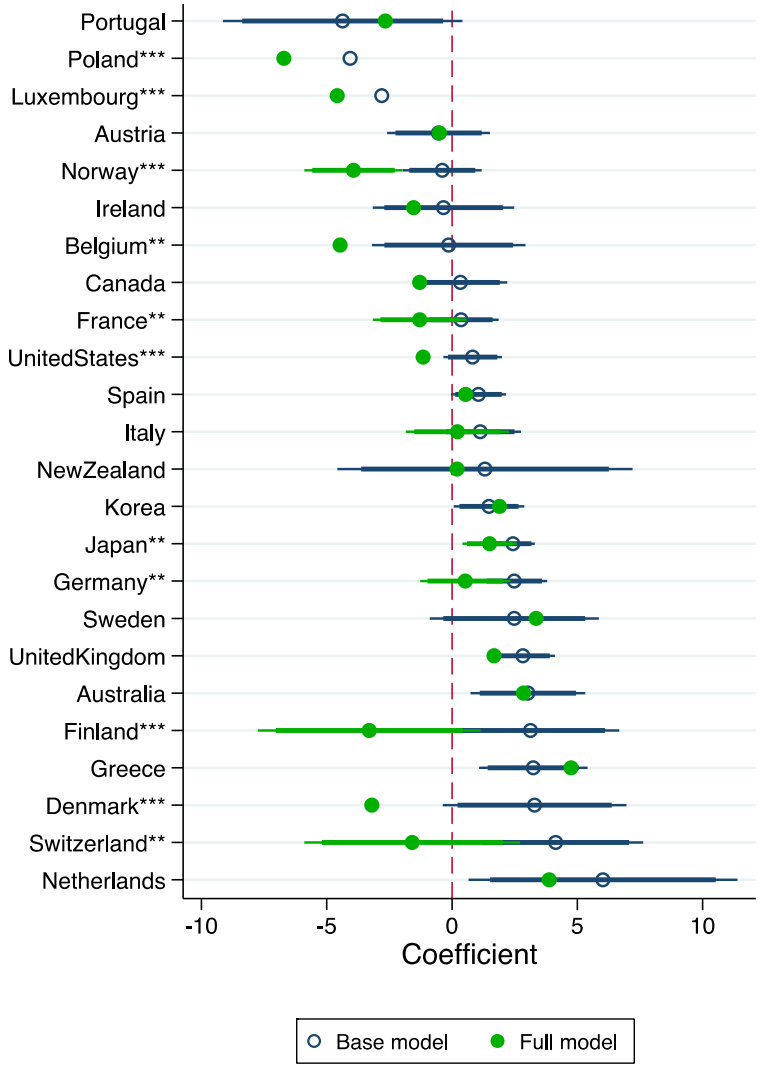
Variable	Description	Observations	Mean	Std. Dev.	Min	Max	Sources
Mitigation aid (log)	Log of bilateral ODA commitments for mitigation of greenhouse gases (as principal purpose; 2017 constant prices, USD, 4-year average). Before creating the log, +1 was added to the variable to avoid the zeroes.	14396	2.17	4.75	0.00	21.38	OECD (2019a)
GDP per capita (log)	Log of GDP per capita of recipient countries, PPP (constant 2011 intl $, 4-year average)	13724	8.65	0.98	6.34	10.82	World Bank (2019)
Population (log)	Log of population of recipient countries (4-year average)	14276	15.44	2.24	9.19	21.04	World Bank (2019)
Other ODA (log)	Log of total bilateral ODA commitments minus bilateral ODA commitments for mitigation of greenhouse gases (2017 constant prices, USD, 4-year average). Before creating the log, +1 was added to the variable to avoid the zeroes.	14396	10.81	6.49	0.00	22.68	OECD (2019a), OECD (2019b)
Political stability	Political stability and absence of violence / terrorism of recipient countries (4-year average)	13916	-0.33	0.93	-3.14	1.46	Teorell et al. (2019); original source: Kaufmann et al. (2010)
Democracy	Level of democracy of recipient countries (Freedom House Index (average of political freedom and civil liberties) combined with imputed Polity2; scale from 0 (least democratic) to 10 (most democratic); 4-year average)	13940	5.94	2.94	0.00	10.00	Teorell et al. (2019); original sources: Freedom House (2019) and Center for Systemic Peace (2019)
Exports (log)	Log of exports from donor to recipient (constant 2012 USD, 4-year average). All missing values were replaced by zeroes. Before creating the log, +1 was added to the variable to avoid the zeroes.	14396	15.93	4.21	0.00	26.14	UN (2019)

FDI (log)	Log of outward FDI flows from donor to recipient (constant 2012 USD, 4-year average). All negative values (which denote disinvestments rather than investments) were transformed into zeroes. Before creating the log, +1 was added to the variable to avoid the zeroes.	10630	6.09	7.98	0.00	23.89	OECD (2019c)
Agreement in the UN	Voting similarity index (0-1) between donor and recipient at the UNGA, equal to (total number of votes where both states agree)/(total number of joint votes). It includes all votes (4-year average)	13940	0.76	0.14	0.07	1.00	Voeten et al. (2009), Voeten (2013); own calculations out of raw data for period after 2014
Kyoto operational	Categorical variable indicating whether the Kyoto Protocol is in force (0 before year 2005, 1 for years 2005-2012, 0.5 for years 2013 onwards; 4-year average)	14252	0.65	0.30	0.00	1.00	Own coding
DNA dummy	Recipient country has a designated national authority for the Kyoto Protocol's Clean Development Mechanism (dummy, 4-year average)	14204	0.65	0.44	0.00	1.00	UNFCCC (2015)
CERs (log)	Log of CERs projected to be generated within year from registered Clean Development Mechanism projects in recipient country (tCO_2e, 4-year average). Before creating the log, +1 was added to the variable to avoid the zeroes.	14396	5.41	6.40	0.00	20.18	IGES (2019)
Energy consumption (log)	Log of total primary energy consumption of recipient country (quadrillion BTU, 4-year average). Before creating the log, +0.0001 was added to the variable to avoid the zeroes.	13820	-2.12	2.30	-6.64	4.92	EIA (2019)
CO_2 intensity (log)	Log of CO_2 emissions intensity of recipient country's economy (kg per 2011 PPP $ of GDP;4-year average). Before creating the log, +0.001 was added to the variable to avoid the zeroes.	13436	-1.67	0.97	-6.91	1.30	EIA (2019); World Bank (2019)

Table A2: Bivariate correlations between the relevant variables

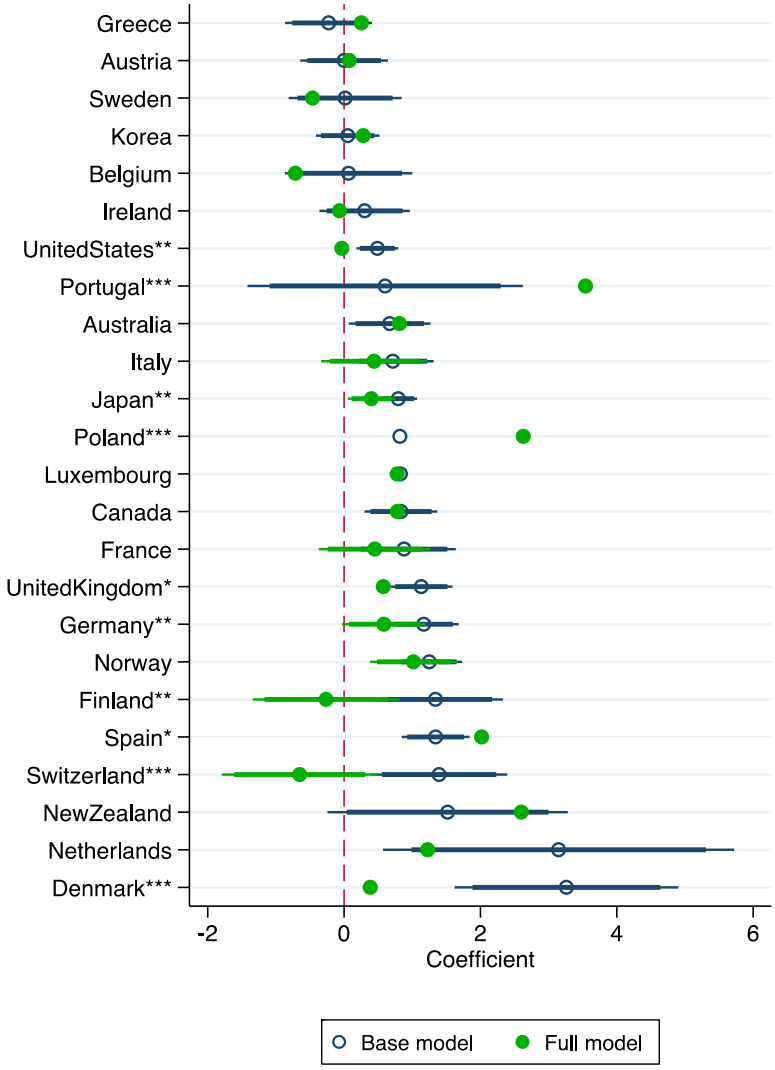
	Mitigation aid (log)	GDP per capita (log)	Population (log)	Other ODA (log)	Political stability	Demo-cracy	Exports (log)	FDI (log)	Agreement in the UN	Kyoto operational	DNA dummy	CERs (log)	Energy consump-tion (log)	CO_2 intensity (log)
Mitigation aid (log)	1.000													
GDP per capita (log)	-0.035	1.000												
Population (log)	0.262	-0.164	1.000											
Other ODA (log)	0.413	-0.267	0.474	1.000										
Political stability	-0.099	0.381	-0.624	-0.379	1.000									
Democracy	0.013	0.146	-0.339	-0.127	0.439	1.000								
Exports (log)	0.330	0.294	0.525	0.428	-0.171	-0.074	1.000							
FDI (log)	0.280	0.221	0.321	0.298	-0.042	0.033	0.500	1.000						
Agreement in the UN	-0.140	0.073	-0.080	-0.192	0.111	0.199	-0.161	-0.104	1.000					
Kyoto operational	0.084	0.047	-0.001	0.019	-0.015	0.019	0.025	0.062	-0.008	1.000				
DNA dummy	0.194	0.064	0.244	0.112	-0.073	0.089	0.219	0.139	-0.031	0.354	1.000			
CERs (log)	0.293	0.126	0.536	0.259	-0.162	0.109	0.408	0.302	0.007	0.112	0.580	1.000		
Energy consumption (log)	0.211	0.414	0.789	0.256	-0.308	-0.225	0.640	0.415	-0.013	0.013	0.228	0.544	1.000	
CO_2 intensity (log)	-0.044	0.501	-0.132	-0.193	0.267	0.020	0.191	0.124	0.062	-0.030	-0.108	-0.012	0.353	1.000

Figure A1: The effect of recipient income, individual donor regressions



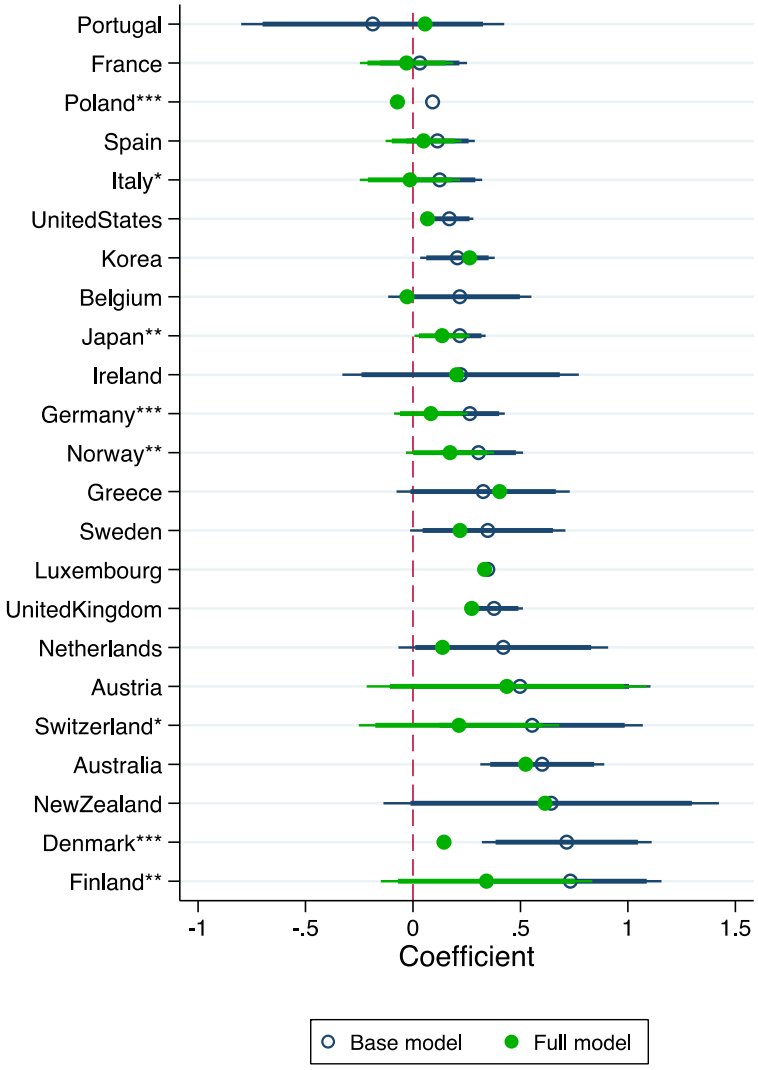
Notes: The confidence intervals (thick line 90%, thin line 95%) show the significance of GDP per capita (logged) for the allocation of a donor's mitigation aid (logged) in a model controlling for this donor's other aid (base model) and for another model controlling also for mitigation efficiency (full model) (individual regression models for each donor). The asterisks following the country names show whether the difference of the coefficient estimates of the full model compared to those of the base model are significant (two-sided Wald test, robust p-values: *** p<0.01, ** p<0.05, * p<0.1). For some donors coefficients and/or confidence intervals could not be estimated due to the small number of observations.

Figure A2: The effect of donor exports, individual donor regressions



Notes: The confidence intervals (thick line 90%, thin line 95%) show the significance of exports (logged) for the allocation of a donor's mitigation aid (logged) in a model controlling for this donor's other aid (base model) and for another model controlling also for mitigation efficiency (full model) (individual regression models for each donor). The asterisks following the country names show whether the difference of the coefficient estimates of the full model compared to those of the base model are significant (two-sided Wald test, robust p-values: *** p<0.01, ** p<0.05, * p<0.1). For some donors coefficients and/or confidence intervals could not be estimated due to the small number of observations.

Figure A3: The effect of donor FDI, individual donor regressions



Notes: The confidence intervals (thick line 90%, thin line 95%) show the significance of FDI (logged) for the allocation of a donor's mitigation aid (logged) in a model controlling for this donor's other aid (base model) and for another model controlling also for mitigation efficiency (full model) (individual regression models for each donor). The asterisks following the country names show whether the difference of the coefficient estimates of the full model compared to those of the base model are significant (two-sided Wald test, robust p-values: *** p<0.01, ** p<0.05, * p<0.1). For some donors coefficients and/or confidence intervals could not be estimated due to the small number of observations.