DOES REGIONAL BIAS AFFECT TO THE CLIMATE CHANGE ADAPTATION AID FLOWS BY RECIPIENT NEED?

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PARK, Seyoung

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

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ABSTRACT

This paper examines donor countries' motivation on climate change adaptation finance flows, using the bilateral panel data reported on Organization for Economic Cooperation and Development (OECD) Development Assistance Committee (DAC) Creditor Reporting System (CRS) from 2012 to 2017. Applying the two-stage Cragg's model, the donors' decision step is divided into (1) whether they give or not and (2) how much they give once they have decided to give. At each stage, the donor random effect and time fixed effect are adjusted at the same time. Empirical results show that the vulnerability of recipient countries to climate change has a positive effect on climate change adaptation aid on average, with mixed results on recipient merit and donor interest. However, when donors are regionally grouped, the results show more variation in outcomes in terms of donors' motivation and recipient region. For instance, European donors tend to consider recipient needs as measured by the ND-GAIN vulnerability index; whereas, Asian donors do not show such a tendency at the allocation stage. Eastern and South-Eastern Asian recipients are more likely to receive climate change adaptation aid from Asian donors at the allocation stage but not from European donors. In the absencce of meta system to measure which recipient countries are less benefited compared to their climate change vulnerabiltiy level in the climate change adpatation finance flows, the results raise concerns on double inequality that still exists in countries left behind with a lack of climate change adaptation capacity and the need to consolidate schemes on aid distribution purposed to climate change adaptation among donor countries.

1. Introduction

It has been over a decade since the ‘adaptation’ marker had been adapted to Organization for Economic Cooperation and Development (OECD) Development Assistance Committee (DAC) Creditor Reporting System (CRS) in 2010. The climate change adaptation marker was once explicitly excluded in 1998 when so-called ‘Rio markers’ were introduced for reporting aid projects regarding climate change and biodiversity and desertification. The reason for the exclusion of the adaptation marker at that time was that mitigation is the ultimate objective of the UNFCCC rather than adaption (OECD 2009).

However, as “double inequity” (or double asymmetry) implies an inverse correlation between responsibility/capability and vulnerability indicators to the adverse impact of climate change (Stern 2007), developing countries indeed suffer the most from the adverse effects of climate change while they have contributed the least to global greenhouse gas (GHG) emissions and have the lowest capability of resisting and recovering from its impact (Füssel 2010; Weiler, Klöck, and Dornan 2018).

Acknowledged by the need and importance of financial procurement for supporting the adaptation capacity of developing countries, the ‘adaptation’ marker was finally introduced on OECD CRS in 2010 as a possible and quantifiable compensation for the double inequity (OECD 2016).

While the new label, adaptation maker, was introduced, the developed party has also agreed on the scope and objectives of allocating scarce resources to the developing world through several global commitments. With the recognition of the different extent of vulnerability each developing country faces, United Nations Framework Convention to Climate Change (UNFCCC) specifically stipulated ‘‘particularly vulnerable” in 1992 to prioritize developing countries whose adaptive capacity is assumed the least (UNFCCC 1992). And at the 2009 Copenhagen Summit, developed country parties of UNFCCC pledged in Cancun in 2010 to provide US$30 billion for mitigation and adaptation in developing countries in the period between 2010 and 2012 and to mobilize $100 billion per year by 2020. The $100 billion per year by 2020 was also agreed to be ‘new’ and ‘additional’ in order not to be overlapped with existing

development aid (UNFCCC 2009). This 100-billion-target was reaffirmed at the Paris Agreement and developed countries agreed to ‘‘significantly increase adaptation finance”, stipulating a balance between adaptation and mitigation at the Paris Agreement (UNFCCC 2015).

Supposedly ‘new and additional’ adaptation aid, whose goal is to assist developing countries that have less capacity to adjust to the negative impacts of climate change, has indeed flowed in accordance with vulnerability? Even though the ideal scheme to assist the developing world that is at risk from the adverse impacts of climate change, there is evidence that proves that the committed adaptation finance has not contributed as much as expected in terms of fairness, raising concerns on those who have no other option but to adapt to climate changes to which they have not contributed. (Paavola and Adger 2006).

This paper focuses on donors’ interest in a specific geographic region as a possible reason for the uneven distribution of climate change adaptation finance to developing countries, along with other variables that aid distribution literature assumed to affect to the donors’ aid distribution behavior. Namely, I assume that one possible factor causing disparities of allocated adaptation aid among developing countries is from donors’ different preferences on a specific region. The reason why each donor has more preference in a specific region could be explained by various factors. It could be related to economic (e.g. amount of exports from donor to recipient), historical (e.g. colonial ties) and political reason (e.g. UN voting relations), and so on. Since these factors are closely linked to each other, finding which factor above is contributing the most to a donor’s interest in a specific region is beyond the scope of this paper. This paper gives more weight as to whether some regional groups of recipients are more likely to get adaptation aid from specific donor region groups. The reason of the recipient and donor regional group comparison comes from the assumption that countries that are in a region, or a continent, would have more possibility to share similar historical and economic traits that might affect other countries that are located in the same region or continent.

To capture how donor groups by region affect allocated climate change adaptation aid, I use the bilateral climate change adaptation aid reported on OECD CRS Rio marker from 2012 to 2017, from the donors' perspective.

The remainder of this paper is structured as follows: Section 2 discusses the literature on the limitation and virtue of OECD DAC adaptation marker and donors' motivation on aid allocation. Section 3 describes the method and data used in this paper, and Section 4 presents the empirical result of the models. Section 5 provides the conclusion.

2. Literature review and expectations

2.1. OECD Rio Marker for tracking climate change adaptation aid

Adaptation finance to assist the developing world to combat adverse effects of climate change flows from various sources, with a dominant portion in the form of bilateral adaptation aid. Most adaptation finance is channeled through Official Development Assistance (ODA) (Barrett 2014).

The Rio marker on climate change adaptation was established by the OECD DAC in close collaboration with the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) to track aid flows in support of developing countries' efforts to implement the Convention. The marker, however, is not without the problem as an ideal method to track adaptation aid.

The first concern comes from inevitable inconsistencies and overreporting of adaptation aid which stems from the absence of clear definitions (Michaelowa and Michaelowa 2011). Clear definition for criteria to report commimnet on each climate change adpataton project was not derived even after the Paris agreement and it still remains in question, with continuous warns raised by reporters (Donner, Kandlikar, and Webber 2016).

The absence of a clear definition exists because separating already existing development aid and climate change adaptation aid is difficult, making tracking the adaptation finance complicated. To giva a example of climate change mitigation project which is distinguished from climate change adaption project, a carbon mitigation aid project can be easily distinguished from a development aid project through the Clean Development Mechanism (CDM), by which developed countries are required to take part in greenhouse gas (GHG) reduction in developing countries in a real, measurable and additional manner (Schneider 2009). By contrast, there is no clear line for distinction between adaptation and development project (Donner et al. 2016). Which label, notably, should be attached to an aid project for a broken water reticulation system by sea-level rise – 'development' or 'adaptation'?

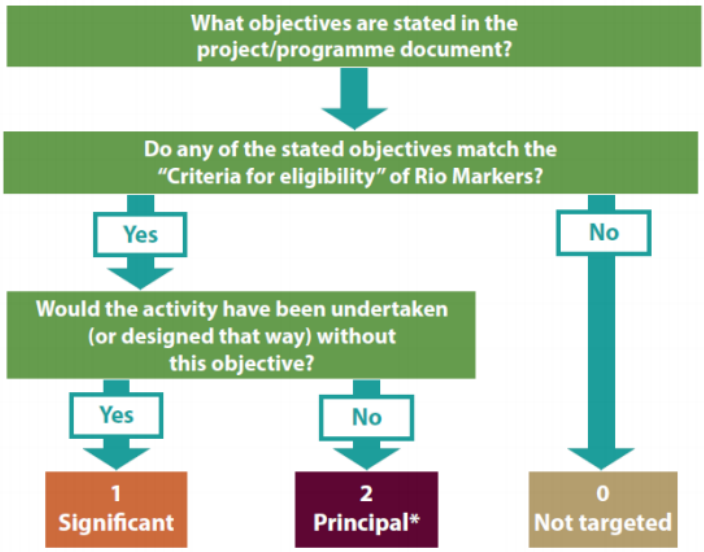
Due to this inherent difficulty of distinguishing adaptation projects from general development, there is inevitable overreporting between adaptation and development done by donor countries and it may give donors and recipients political motivation, drawing inconsistencies among reporters (Michaelowa and Michaelowa 2011).

Another concern comes from the notion "new and additional" stated in the 2009 Copenhagen Summit, not to jeopardize recipient countries from enhancing development capacity with development aid. This "new and additional" statement results in political competition among recipients to get additional resources, increasing distorted results of misreporting of needs and inefficient allocation of adaptation aid (Webber 2015). Although committed definitional requirements are clearly stated that adaptation aid should be 'new and additional' on already existing global development flows, a pathway to tackle and measure what is new and additional is still a long way to go (Donner et al. 2016). Michaelowa and Michaelowa (2011), on the other hand, pointed out that reported project coding could be also biased due to the different levels of preference or concerns of individual reporters who have different perspective on environmental protection due to thier different ideological orientation, which further increases concerns on definition issues.

How can individual reporters of a donor country who has a different perception of adaptation aid would clearly separate and report their commitment to adaptation aid other than development aid in an identical

way? This situation would worsen when they are faced with a choice of whether the contributed adaptation aid project is for a "principal objective" or "significant objective." The OECD has required donors to select the former if "the objective (climate change mitigation or adaptation) is explicitly stated as fundamental in the design of, or the motivation for, the activity", while the latter if "adaptation is important but not the main objective" (OECD 2016).

Figure 1. Decision tree for scoring an activity against a Rio marker



Sources : OECD DAC RIO MARKERS FOR CLIMATE: HANDBOOK

While the argument strengthens that adaptation finance should be mainstreamed into a broader development project for enhancing livelihood so as to ultimately reduce vulnerability to climate change and strengthen to its negative impact(Jones et al. 2012; McCubbin, Smit, and Pearce 2015), current OECD Rio Markers are not yet likely to be the ideal measure to separate them and track aid allocation (Donner et al. 2016).

With the lack of a clear definition to report, scattered adaptation aid sources and reporting systems could distort the total committed amount of adaptation aid and therefore, hinder efforts and practices to make adaptation aid given to where it is needed most, drawing attention to the need of an independent metadata system in which all aid project from diverse sources are included, enhancing independent analyses to check global climate change aid promises(Donner et al. 2016). The introduction of this metasystem will also enhance transparency and trusteeship among stakeholders to tackle the problems around reported adaptation aid flows (Michaelowa and Michaelowa 2011).

Even though the inherent drawbacks to report climate chang adaptation aid described above, The OECD CRS system enhance comparison of dataset so that possible double count problem which result from overreporting could be removed by data manipulation and still provide best resources to analyze aid allocation pattern with comprehensive bilateral aid flows data that is not found elsewhere and detailed project-level information (Betzold and Weiler 2017).

2.2 Donors' motivation for general development aid allocation

Aid allocation literature has analyzed bilateral development aid donors' decision patterns, by which three motivations are represented: recipient need, donor interest, and recipient merit. A series of studies to determine a donors' decision to allocate financial resources to other countries first started to demonstrate the mechanism of donors' aid-giving activity by recipient's need and donors' interest in the 1970s (Dudley and Montmarquette 1976; McKinlay and Little 1977). The arguement that recipient merit does matter in the donors' decision was raised later, in the 1990s (Weiler et al. 2018). The recipient need model is based on the notion that donors allocate aid resources to meet the recipient's need represented mostly by the recipient's poverty level. Donors' interest model, on the other hand, posits that donors prioritize their economic and/or political interest rather than the recipient's need. To borrow a phrase from the former

British Prime Minister David Cameron, two models of recipient need and donors' interest are described as following one's 'heart' for the former and one's 'head' for the latter (Lightfoot, Davies, and Johns 2016 as cited in Betzold and Weiler 2018). The last model which appeared later, "recipient merit", refers to good governance and policies in recipient countries so that donor countries give much more financial aid for the efficient utilization of given resources and for promoting democratic institutions (Betzold and Weiler 2018). A large body of literature has investigated the donors' decision on development aid allocation to developing countries based on these three notions, and it seems that donors take account of their own interest the most, while considering others, recipient need and merit, to some extent (Betzold and Weiler 2018).

2.3. Donors' motivation for climate change adaptation aid

When it comes to climate change adaptation aid allocation, which motivation model would affect donors' decision? Do donors consider recipients' need? As long as the objective of aid is in relation to climate change adaptation, recipient needs could be translated as the vulnerability level of the recipient country to the negative physical and socio-economic impacts of climate change. It is evident that the more a country is exposed to the negative impacts of climate change, the more support it needs (Klein 2009). This is true, in particular, for those countries who have a lower capacity for adaptation readiness(Mori, Rahman, and Uddin 2019). There seems to be agreement among many authors to prioritize the most vulnerable countries in climate change adaptation aid distribution, which is in line with series of global accord (Barr, Fankhauser, and Hamilton 2010a; Grasso 2010; Paavola and Adger 2006).

Measuring and accessing the vulnerability level of a country, however, entails inevitable incompleteness in terms of concept, method, and empirical aspects (Klein 2009). First, we could not help but consider vulnerability in terms of physical and socio-economic aspects at the same time. Notably, it is still in question how to weight indicators representing physical and socio-economic aspects to measure each aspect and incorporate them to represent the climate change vulnerability as a whole for consistent tracking

of vulnerability level of a country. This lack of complete criteria for measuring vulnerability to the adverse impacts of climate change allows for adaptation aid allocation framework to depend on political and normative motivation rather than solely on the calculated indicator (Betzold and Weiler 2018; Füssel 2010; Klein 2009).

Even though the difficulties exist from the absence of a clear definition for reporting adaptation aid to inherent impossibility of measuring definite vulnerability level as described in the previous part of this paper, growing literature has contributed to the documentation of the various determinants of adaptation aid donors' decision with various source, scope, and method, remaining the various results on how vulnerability level of recipient coutry affect to adaptation aid distribution.

Most of the climate change adaptation authors demonstrate that donors consider the vulnerability level of the recipient country in the decision-making process for adaptation aid distribution as stipulated in the preamble of UNFCCC (Betzold and Weiler 2017; Mori et al. 2019). This implies that donors deem the vulnerability level of the recipient country as one of the crucial criteria when they do distribute adaptation aid (Mori et al. 2019).

Betzold and Weiler (2017) assert that the more a country has a high risk of physical vulnerability, mostly climate-induced natural disasters, the bigger the amount of aid allocation the country receives, suggesting that donors, overall, allocate bilateral aid aligned with the global accord. Mori, Rahman, and Uddin (2019) on Adaptation Fund (AF), one of the multilateral climate finance channels, also find that the vulnerability level of recipients matters on both access to and the amount of Adaptation Fund(AF), using vulnerability index of Notre Dame Global Adaptation Initiative (ND-GAIN), in which exposure, sensitivity, capacity to the adverse impacts of climate change are reflected. On the other hand, when low income coutntires are categoraized again, they also find low-income countries are more likely, while the least developed countries that are less likely to access the fund (Mori et al. 2019), implying adaptation aid gap among countries of the global south when economic capacity is considered.

When vulnerability is fractionalized into different dimensions as a physical and socio-economic factor, however, the result is mixed since low socio-economic capacity and adverse impact of climate change are closely linked to each other, if a country has low socio-economic capacity, it could be translated as the country is vulnerable to climate change impact in terms of socio-economic dimension. Low socio-economic capacity would result in less adaptation fiancé received when decision makers focus on efficient and productive use of adaptation aid. This mixed result also implies that adaption aid distribution by vulnerability index itself may not always ensure adaptation finance flow by recipient need (Remling and Persson 2015; Stadelmann et al. 2014).

As the first to investigate the allocation of adaptation finance at the subnational level, Barrett (2014) researched across Malawi and found that the result could vary when the vulnerability is fractionalized into physical and socio-economic factor, showing that socio-economic vulnerability is negatively related to adaptation aid while physical vulnerability and donor interest matters in aid distribution. The backgournd behind negative relationship between the socio-economic vulnerability and adaptation finance was that districts with pre-existing infrastructure would demonstrate an ability to manage and use finance productively. That means the economically underprivileged regions also benefit the least from the adaptation aid across Malawi, showing the existence of aid gap at the subnational level. This Adaptation aid gap is confirmed by studies in the Oceania region (Donner et al. 2016); Pacific Island Countries(Betzold 2017), with the results that indicate that similar levels of physical vulnerability among recipients do not necessarily ensure similar levels of adaptation aid among countries. This result is supported by a cluster of literature on a more broad scope of study as described below.

To my knowledge, Weiler et al(2018) were the first to examine bilateral adaptation finance with a dyadic set of OECD Rio marker data, confirming that the more physically vulnerable a country is to the adverse impact of climate change, the more likely it is to receive adaptation aid in both absolute amount and per capita terms. That is naturally true for Small Island Developing Counties which is embedded as a

category of ‘particularly vulnerable countries’ in the IPCC document, meaning that donors account for countries that are in ‘particularly vulnerable countries’ list.

According to their result, lower adaptation capacity, however, does not necessarily mean that they do receive more adaptation aid, which is consistent with Barrett (2014)’s outcomes of the subnational-level study on Malawi, while good governance or donors’ political and economic interest do matter in practice. This result implies that adaptation aid is similarly following the patterns of general development aid as a subset of it.

Studies on one of the multilateral adaptation fund, Adaptation Fund(AF), reach similar results on the positive relationship between physical vulnerability and the probability to receive support from the fund (Mori et al. 2019; Remling and Persson 2015; Stadelmann et al. 2014). According to the outcomes, decision-makers on multilateral finance flow to the project does not consider recipients in particular, that is overall vulnerability level to the adverse impact of climate change in the recipient country is not the major criterion for the decision-making (Remling and Persson 2015)

Overall, it seems that donors surely do take account of the physical vulnerability level of the recipient, but not as the absolute criteria for adaptation aid allocation. This could be rational, to some extent, because donors weigh other factors rather than rely solely on recipient need. The possible reason behind this is substantiated by several literature as prioritizing the most vulnerable could be a trade-off with the marginal effectiveness of adaptation finance. (Barr et al. 2010a; Mori et al. 2019)

Given the revealed pattern of adaptation aid flow not necessarily flows by recipient need, both physical and socio-economic dimension of recipient countries, other factors that might affect the donors’ decision–recipient merit and donors’ interest—are confirmed by several adaptation aid literature.

How does the recipient merit function on the donors’ decision on adaptation aid distribution? In climate change adaptation aid distribution, recipient merit matters to donor countries for a similar purpose as it does in general development aid distribution—that is, for the efficiency of given aid and for the promotion of

democratic institutions by giving more aid money to recipient countries with good governance and policies (Betzold and Weiler 2018). The results with donors' behavior led by recipient merit are mixed. Several studies demonstrate that good governance, measured by the Worldwide Governance Indicators (WGI);(Betzold and Weiler 2017; Weiler et al. 2018), and a higher level of democracy, measured by Freedom House;(Weiler et al. 2018) is advantageous to recipient countries in order to receive a higher level of climate change adaptation aid.

However, a country with good governance is expected to better utilize given resources, and hence the country is less likely to be highly vulnerable to climate risks (Robertsen, Francken, and Molenaers 2015) More precisely, given the same level of physical vulnerability to climate risks, a country with good governance is likely to have a lower level of socioeconomic vulnerability than a country with poor governance.

With regard to donors' interests, results are also mixed. Donor utility which is also termed as path dependency and accounts for cost minimization and donors' accessibility with the benefit of established aid network is proven to have a positive relationship with adaptation aid flow, according to Barrett (2014). Colonial ties and trade are also proven to have a positive impact on climate change adaptation, but other factors, such as geographic distance between donor and recipient country and whether donor and recipient have the same UN voting patterns, do not show any significant impact on adaption aid flow (Weiler et al. 2018).

2.4. Hypothesis.

Based on the theoretical framework above, I expect bilateral climate change adaptation distribution to be affected by three motivations of donors: recipient need(H1-1, H1-2), recipient merit(H2), and donor interest(H3). The hypothesis for the empirical test on this paper is as below.

H1-1 vulnerability level of recipient country which reprented by ND-GAIN index matters in climate change adaptation aid distribution. The more vulnerable a country from the adverse impact of climate change is, the more adaptation aid it should receive.

H1-2 Donors consider adaptative capacity of recipient country when they allocate climate change adaptation aid. Namely, donors would give more climate change adaptation aid to a recipient if the recipient's economic or superficial condition such as whether they are grouped into a particularly vulnerable country group; African, SIDS, and LDC.

H2 Donors would give more climate change adaptation aid to a recipient if the recipient's governance score is better than others in the case that recipient merit matters.

H3 The more a country has an economic or historical relationship with donor countries, the more adaptation aid it should receive. Also, whether a recipient belongs to the region favored by a group of donor countries located in a specific region has an effect on the amount of adaptation aid. In this case, the donors' interest is considered.

I expect that the more physically vulnerable country would have more possibility to get the climate change adaptation aid in terms of both access and amount (H1-1). In the case of a positive relationship between adaptation aid and physical vulnerability proxies that are set in this paper, the interpretation would be that recipients need in terms of vulnerability level that reprensing all aspects of exposure, sensitivity, and adaptive capacity does matter. Moreover, since lower economic level and vulnerable country group would mean that a country's lower capacity to combat climate change, positive outcome between adaptation aid and these variables would be interpreated as recipient need matters in terms of adaptive capacity of

recipient country (H1-2). On the other hand, lower governance index would mean that a country's lower capacity to combat climate change and cause worry of less efficient use of given aid money, I expect that lower governance index would hamper donors' motivation on recipient merit (H2). However, if a recipient country is in a relationship with donors in the form of giving interest to donors, donors might take advantage of giving climate change aid to maintain or encourage the status quo as they do in general development aid, meaning that the donors' interest also works in climate change adaptation aid. In addition to this, as an additional form to test donors' interest, each donor and recipient country's continent would show a geographical adaptation distribution pattern with the assumption that the specific interest of donors to a specific region of the recipient would matter (H3).

3. Data and methods

3.1. Dependent variable: adaptation aid

In the model of this paper, the data from OECD Rio Marker on bilateral climate-related development finance is used as a dependent variable. OECD Climate change Rio Marker system provides data both from the recipient perspective and provider perspective. In this paper, however, only the data from the provider perspective is introduced in the view that the allocation pattern from the perspective of the donor better reflects the donors' intention to allocate aid. Also, adaptation aid flow is calculated to capture both 'principal' and 'significance' at once. To do so, the summation of 'principal' and 'significance' is applied in which aid flows labeled with 'significance' is multiplied by 0.5 whereas 'principal' is adopted as it is, following the way most donors do so when they report climate change-related adaptation aid, though the adjusted value differs by donors (Betzold and Weiler 2018). All figures used are converted into constant 2016 US dollar as provided on OECD data and introduced on per capita basis of recipient country in a given year.

3.2. Independent Variables

3.2.1. Recipient Need

3.2.1.1. ND-GAIN Vulnerability Index

This paper uses the ND-GAIN Vulnerability index as a proxy on how much a recipient country is physically vulnerable to the adverse impacts of climate change. The adoption of the ND-GAIN index is suited for the purpose of this research because it provides a comparable national dataset of 182 countries. According to ND-GAIN technical report contributed by Notre Dame Global Adaptation Initiative, the ND-GAIN vulnerability index is calculated to show six aggregated dimensions - Water, Agriculture, Health, Infrastructure, Food and Ecosystems- in terms of c. The higher value of the ND-GAIN vulnerability index is, the more a country is vulnerable. In the light of the agreement of donor countries by series of international agreements as cited in the earlier part of this paper, the expected relationship with the dependent variable is positive.

3.2.1.2. 'Particularly Vulnerable' Country Dummy

As stipulated in the UNFCCC document(UNFCCC 2009) and mentioned earlier in this paper, whether the recipient country is included in the particularly vulnerable country group could be criteria for donors to allocate climate change adaptation aid. The particularly vulnerable groups encompass the Least Developed Countries (LDCs), Small Island Developing States (SIDS), and African countries. I expect that donors treat these three vulnerable country traits differently and adopt each of the variables as a dummy in the model.

3.2.1.3. GDP per capita, PPP

GDP per capita, PPP is also included as an explanatory variable reflecting recipient need in terms of economic perspective. Given the ethical norm of aid distribution, it makes sense that poorer countries should receive more aid money. But conjectured with the possible reasons on the matter of efficient allocation of aid money, marginal effect of allocated money, many development aid researches have proved a nonlinear correlation between allocated aid and per capita GDP of the recipient country. With the

multicollinearity issue, however, the quadratic coefficient of GDP per capita to the climate change adaptation aid is automatically excluded. Logged and one-year lagged GDP per capita of the recipient country is imported, reflecting the time taken for decision making and implementing processes. The data from World Bank is utilized.

3.2.2. Recipient Merit

3.2.2.1. Worldwide Governance Indicators (WGI)

As proven by several pieces of literature (Barr, Fankhauser, and Hamilton 2010b; Weiler et al. 2018), Good Governance acts as a merit of recipients to receive more aid. In this paper, Worldwide Governance Indicators (WGI) is introduced as a proxy for good governance of the recipient country. To rank a country's governance level, WGI provides six criteria: (1) voice and accountability; (2) political stability; (3) absence of violence; (4) government effectiveness; (5) rule of law; and (6) control of corruption. The higher the WGI score, the better a country's governance. In a view that recipient countrys' good governance represented by six criteria above would be proxy for the reliance and the trasparancy for efficient and effective use of aid resources at the side of donor country, WGI is added to test recipient merit. I incorporated each figure from the six criteria and divided it by six to have equal weight. WGI variable is also adjusted to be lagged one year.

3.2.3. Donors' interest

3.2.3.1. Export from donor to recipient

As a variable for donors' interest, the total amount of export from donors to recipients is introduced. Aid giving donors might use adaptation aid taking into account their own economic interests, expecting to promote their goods and services in recipient countries (Neumayer 2003a). The data was exploited from UN Comtrade and log-transformed and lagged by one year given the administrative work entailed in aid distribution. In terms of donors' motivation for its own benefit, export volume from a donor country to a recipient is assumed to have a positive relationship with adaptation aid finance flows to the recipient country

because donors would pursue more aid distribution for more economic profit by means of trade. (Weiler et al. 2018; Younas 2008)

3.2.3.2. Colonial experience dummies

The colonial experience of the recipient country is introduced as a factor that may affect the donors' decision on allocating adaptation aid in the view that donors try to maintain their influence in the former colonies through aid allocation (Weiler et al. 2018). I assume that similar motivation works for donors when they distribute climate change adaptation aid. Data from CEPII, Centre d'Études Prospectives et d'Informations Internationales, is used and transformed to be a dummy variable, representing 0 if there is no colonial relationship between the recipient and donor country and 1 otherwise regardless of the period of colony.

3.2.3.3. Geographic region dummies

In the research for donors' behavior on aid distribution so far, some literature focus on the geographical distance between the capital of donor and recipient country. This view comes from the assumption that the greater the geographical proximity between the donor and recipient, the more aid flow between them. Favoring a neighbor as a possible recipient, however, has not been clearly substantiated so far (Neumayer 2003b). Instead of the geographic distance between the donor and recipient countries, I focused on the donors' interest in a specific region. Behind this decision is that each donor might have a special interest in a specific region that is distinctive from other donors and the preference is similar if donors are in the same regional group or continent because they are more likely to share more similar historical and economic interests. To discern the effect of the region represented by continent, I used regional specifications officially posted for the statistics for the sustainable development goals of the United Nations. Donors' regional group is divided as below.

Table 1. Regional classification of OECD donors

Region	OECD donors		
Europe	Austria	Iceland	Slovak Republic
	Belgium	Ireland	Slovenia
	Czech Republic	Italy	Spain
	Denmark	Luxembourg	Sweden
	Finland	Netherlands	Switzerland
	France	Norway	United Kingdom
	Germany	Poland	
	Greece	Portugal	
Asia	Japan	Korea, Rep.	
Northern America	Canada	United States	
Oceania	Australia	New Zealand	

3.2.5. Control variables

In a view that donor might consider path depency in the decision process of newly introduced climate change adpatiation fiannce distribution, the Official Development Assistance flows from donors to recipients in a given year are adopted as control variables. Figures are converted in a constant form in 2019 and adjusted as lagged by one year and logged with the skewed nature of the data. As a second control variable, the population size of a recipient country is added. The data also lagged by one year, taking into account the decision-making period in the donor country.

Table 2. List of variables used in statistics.

Indicator	Source	Transformation	
		Logged	Lagged
Dependent variable			
Adaptation purposed aid per capita (principal*1+significant*0.5) (2016 USD thousand)	OECD DAC CRS	v	
Independent variable			
Recipient Need : Exposure, Sensitivity, and Adaptive Capacity (H1-1)			
Vulnerability level to the adverse impact of climate change	ND_GAIN (Vulnerability Indicator)	v	v
Recipient Need : Adaptive capacity (H1-2)			
African Countries (Dummy variable)	UN Statistics Division		
SIDS, Small Island Developing States (Dummy variable)	UN Statistics Division		
LDC, Least Developed Countries (Dummy variable)	UN Statistics Division		
GDP per capita, PPP	World Bank	v	v
Recipient Merit (H2)			
WGI (Worldwide Governance Indicators)	World Bank		v
Donor Interest (H3)			
Export (total goods and services) from donor to recipient	UN Comtrade	v	v
Geological Region (Dummy variable)	UN Statistics Division		
Colonial Ties (Dummy variable)	CEPII		
Control Variable			
Total general development aid (2019 USD)	OECD Statistics	v	v
Population	World Bank	v	v

3.3. Modelling strategy

Empirical analyses on foreign aid allocation have been mostly conducted by using one of three models, namely the two-part model, the Heckman model, and Tobit regression. To deal with the cluster of zero which is a trait of foreign aid data, the two-stage model is one option by which estimation techniques are distinguished in two steps. The first step of the two-stage model is to estimate whether the countries get the chance of receiving foreign aid using the probit analysis whereas the next step is run by ordinary least

squares (OLS) to estimate how much the countries receive foreign aid. The two-stages model assumes that each step is independently related to each other, and this is the distinctive trait of the two-stage model to the other method. For instance, Heckman's two-step estimator is adjuted where the relation of each step on aid allocation is deemped as depently decided. (Neumayer 2003a). Since it is more reasonable to assume that the decision-making process of donor countries has a time gap between where to distribute the aid and how much it is, two-stage model is used in this test. Also, the donor country random effect is adjusted in a view that a donors' aid distribution behavior to many recipients in a given year is not likely to be determined independently. Time fixed effect is included to capture yearly fluctuations. Each stage of the model is conducted two times to see how regionally grouped donors follow the donors' behavior.

Thus, the formula for the model used in the first stage is

$$logit(\pi_{ij}) = \beta_0 + \beta_1\chi_{1ij} + \ldots + \beta_{11}\chi_{11ij} + \mu_j$$

$$\pi_{ij} = \mathrm{P}(y_{ij}=1 |\, \chi_{1ij}, \ldots, \chi_{11ij}, \mu_j)$$

$$\mu_j \sim \mathcal{N}(0, \sigma_\mu^2)$$

y_{ij} represents the binary decision by donor j to allocate aid (1) or not (0) to recipient i, while χ_{1ij} to χ_{11ij} is introduced as independent variables observed for observation iii on which donors j may refer to their decision, and μ_j : donor random effects. In the model by grouped donor region, i is limited as a donor in the relevant region.

On the other hand, the second stage of the model analyzes how much donors distribute their scarce resources to recipient countries once they decide to provide aid to the recipient in the first stage. In this case, $y1_{ij}$ is 1. The formula for the second stage is

$$y2_{ij}=\beta_0 + \beta_1\chi_{1ij}+\ldots+\beta_{11}\chi_{11ij} + \mu_j + e_{ij}$$

$$e_{ij} \sim \mathcal{N}(0, \sigma_e^2)$$

$$\mu_j \sim \mathcal{N}(0, \sigma_\mu^2)$$

$where\ y2_{ij}$ represent the amount of adaptation aid committed by donor j to the recipient i selected in the first stage, χ_{1ij} to χ_{11ij} are introduced as independent variables observed for observation iii on which donors j base their decision, μ_j are donor random effects, and e_{ij} are the remaining error terms.

4. Findings

Table 3 and Figure 1 show summary statistics for all numerical variables used in the statistical models and correlation matrix of all numerical variables.

Table 3. Summary statistics for all numerical variables used in the statistical models.

Variable	N	Mean	SD	Median	Min	Max
Adaptation aid (mn. US$) (principal*1 + significant*0.5)	35654	0.828	7.313	0.024	0	475.429
ND-GAIN Vulnerability	34686	0.494	0.077	0.5	0.335	0.681
GDP per Capita, PPP	35208	2975.936	2997.886	1652.284	219.962	18236.307
WGI	35617	-3.079	2.802	-2.918	-13.657	7.185
Exports (mn. US$)	35654	3708.86	186.595	16124.685	0	240200
Total general development aid (mn, US$)	35649	128.937	313.569	29.32	0	4546.21
population (mn)	35560	128.311	314.767	26.99	0.01	1378.665

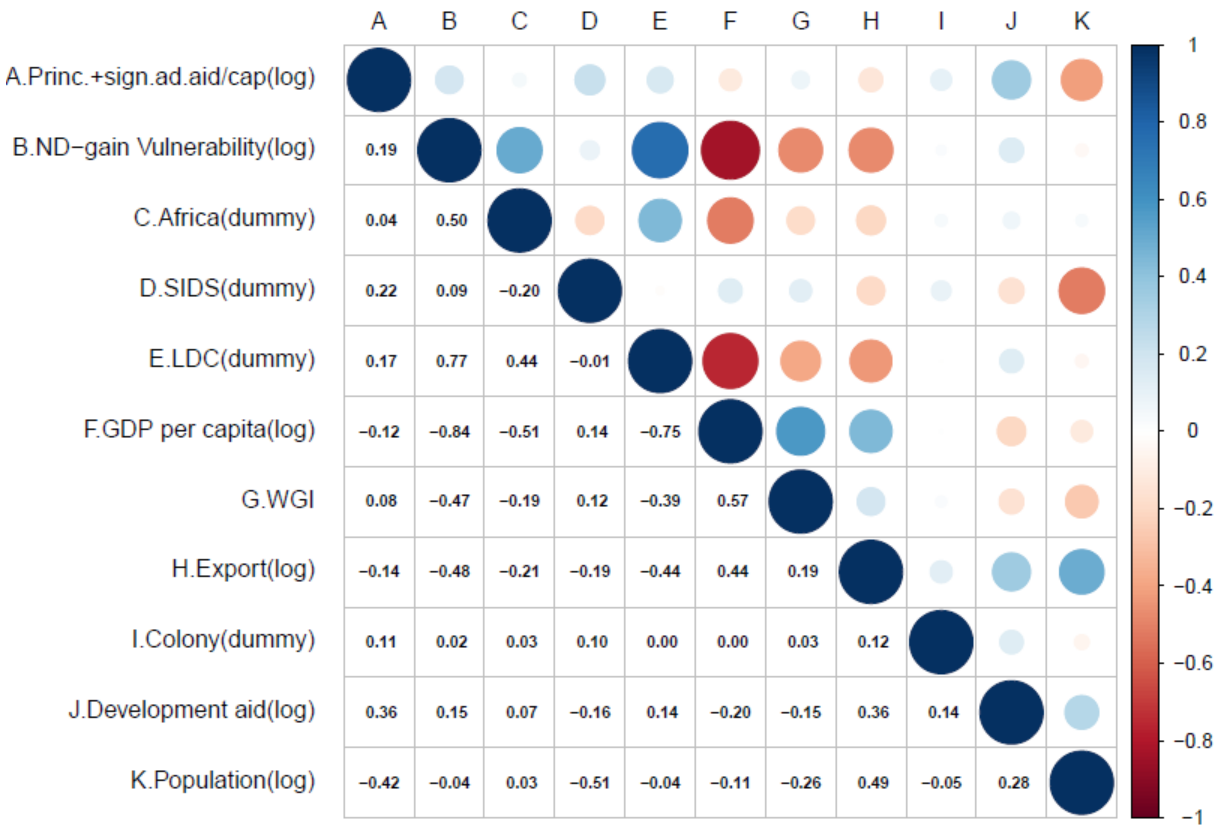


Figure 1. Correlation matrix for all numerical variables used in the statistical model.

Table 5. Principal and discounted significant adaptation aid, selection stage, all

	dv : Principal and significant adaptation aid/cap+							
	(1)		(2)		(3)		(4)	
ND-GAIN vulnerability index+	2.142***	(0.234)	2.650***	(0.089)				
Africa	0.360***	(0.101)			0.041	(0.034)		
SIDS	-0.239**	(0.077)			0.044	(0.063)		
LDC	0.081	(0.047)			0.265***	(0.043)		
GDP/cap+	-0.077*	(0.038)			-0.278***	(0.024)		
WGI	0.003	(0.007)			-0.005	(0.006)		
Export+	-0.038**	(0.013)					-0.151***	(0.010)
Ex-colony	0.164**	(0.053)					0.266***	(0.051)
Eastern and South-Eastern Asia	0.192***	(0.051)					0.09	(0.049)
Europe	-0.415***	(0.097)					-0.863***	(0.089)
Latin America and the Caribbean	0.485***	(0.061)					0.140**	(0.054)
Northern Africa and Western Asia	-0.011	(0.095)					-0.185**	(0.068)
Oceania	-0.039	(0.132)					0.036	(0.112)
Sub-Saharan Africa	-0.259*	(0.114)					0.279***	(0.048)
General development aid+	-0.02	(0.010)	-0.027**	(0.009)	-0.027**	(0.009)	0.036***	(0.009)
Population+	-0.052**	(0.016)	-0.072***	(0.009)	-0.075***	(0.009)	0.016	(0.014)
(Intercept)	4.945***	(0.336)	4.521***	(0.223)	4.573***	(0.309)	3.660***	(0.253)
AIC	35118.687		35582.215		36214.088		36273.41	
BIC	35312.853		35666.72		36332.608		36417.4	
Log Likelihood	-17536.344		-17781.107		-18093.044		-18119.705	
Observations	34268		34564		35092		35242	
Groups (donors)	28		28		28		28	
Random intercepts (donors)	0.837	(0.132)	0.828	(0.126)	0.829	(0.125)	0.855	(0.134)

Notes: * p<0.05, ** p<0.01, *** p<0.001, +Logged values; yearly data lagged by one year; year dummies included but not shown; standard errors in parentheses.

Table 6. Principal and discounted significant adaptation aid, allocation stage, all

	dv : Principal and significant adaptation aid/cap+							
	(1)		(2)		(3)		(4)	
ND-GAIN vulnerability index+	4.504***	(1.926)	4.182***	(0.740)				
Africa	1.301	(0.250)			0.915	(0.063)		
SIDS	1.058	(0.145)			1.473***	(0.169)		
LDC	1.041	(0.103)			1.207*	(0.107)		
GDP/cap+	0.773***	(0.053)			0.750***	(0.038)		
WGI	1.080***	(0.014)			1.075***	(0.012)		
Export+	1.058*	(0.025)					0.981	(0.017)
Ex-colony	1.877***	(0.239)					1.833***	(0.224)
Eastern and South-Eastern Asia	1.465**	(0.175)					1.360**	(0.160)
Europe	0.856	(0.166)					0.586**	(0.108)
Latin America and the Caribbean	1.422**	(0.172)					1.082	(0.123)
Northern Africa and Western Asia	0.954	(0.166)					0.699**	(0.094)
Oceania	1.182	(0.284)					1.573*	(0.317)
Sub-Saharan Africa	0.749	(0.166)					1.251*	(0.129)
General development aid+	1.779***	(0.033)	1.834***	(0.030)	1.831***	(0.030)	1.845***	(0.031)
Population+	0.380***	(0.012)	0.383***	(0.007)	0.399***	(0.008)	0.386***	(0.010)
(Intercept)	389.051***	(250.877)	113.022***	(39.623)	203.728***	(118.033)	43.424***	(17.342)
AIC	23051.018		23663.547		24105.925		24282.006	
BIC	23209.014		23736.22		24205.324		24401.4	
Log Likelihood	-11501.509		-11820.773		-12037.963		-12123.003	
Observations	5341		5468		5578		5614	
Groups (donors)	28		28		28		28	
Random intercepts (donors)	0.759	(0.113)	0.732*	(0.108)	0.745*	(0.111)	0.774	(0.115)

Notes: * p<0.05, ** p<0.01, *** p<0.001, +Logged values; yearly data lagged by one year; year dummies included but not shown; standard errors in parentheses.

Table 7. Principal and discounted significant adaptation aid, selection stage by regional group of donor countries.

	dv : Principal and significant adaptation aid/cap+							
	(1) Europe		(2) Asia		(3)Northern America		(4) Oceania	
ND-GAIN vulnerability index+	1.922***	(0.310)	2.048***	(0.487)	1.978*	(0.782)	2.188	(1.356)
Africa	0.125	(0.124)	0.186	(0.240)	1.993***	(0.394)	-1.27	(1.135)
SIDS	-0.500***	(0.097)	-0.085	(0.165)	0.32	(0.284)	1.718*	(0.838)
LDC	0.081	(0.060)	0.035	(0.112)	0.460**	(0.146)	-0.503	(0.258)
GDP/cap+	-0.025	(0.051)	0.230**	(0.082)	-0.611***	(0.118)	0.016	(0.254)
WGI	0.002	(0.009)	-0.005	(0.016)	0.076***	(0.021)	-0.094	(0.050)
Export+	-0.113***	(0.019)	-0.012	(0.038)	-0.013	(0.055)	-0.041	(0.088)
Ex-colony	0.279***	(0.059)	-1.744**	(0.621)	0.548	(0.281)	-0.425	(0.420)
Eastern and South-Eastern Asia	0.079	(0.068)	0.186	(0.119)	0.592***	(0.167)	-0.034	(0.297)
Europe	-0.398**	(0.123)	-0.789**	(0.269)	0.873**	(0.315)	-13.247	(405.953)
Latin America and the Caribbean	0.409***	(0.080)	-0.032	(0.129)	1.611***	(0.250)	0.715	(0.536)
Northern Africa and Western Asia	0.235	(0.126)	0.034	(0.218)	-0.543	(0.290)	0.154	(0.703)
Oceania	-0.696*	(0.301)	0.166	(0.226)	13.914	(762.924)	-1.697*	(0.845)
Sub-Saharan Africa	-0.079	(0.143)	0.144	(0.264)	-1.696***	(0.448)	2.246	(1.172)
General development aid+	-0.042**	(0.013)	-0.014	(0.025)	-0.031	(0.043)	0.045	(0.080)
Population+	0.028	(0.023)	-0.018	(0.043)	-0.13	(0.069)	-0.057	(0.136)
(Intercept)	4.574***	(0.430)	1.007	(0.858)	9.250***	(0.969)	4.164*	(2.118)
AIC	23200.721		6182.971		3974.32		1243.006	
BIC	23385.605		6333.168		4121.4		1370.501	
Log Likelihood	-11577.36		-3068.4855		-1964.1599		-598.50298	
Observations	22890		5066		4424		1888	
Groups (donors)	22		2		2		2	
Random intercepts (donors)	0.892	(0.163)	0.642	(0.324)	0.529	(0.282)	0.399	(0.287)

Notes: * p<0.05, ** p<0.01, *** p<0.001, +Logged values; yearly data lagged by one year; year dummies included but not shown; standard errors in parentheses.

Table 8. Principal and discounted significant adaptation aid, allocation stage, by regional group of donor countries

	dv : Principal and significant adaptation aid/cap+							
	(1) Europe		(2) Asia		(3)Northern America		(4) Oceania	
ND-GAIN vulnerability index+	7.322***	(4.121)	3.091	(2.828)	2.583	(3.540)	0.612	(0.666)
Africa	1.195	(0.284)	3.367**	(1.491)	1.096	(0.646)	0.321	(0.265)
SIDS	0.797	(0.144)	1.067	(0.319)	2.858**	(1.127)	3.077**	(1.076)
LDC	1.014	(0.127)	0.843	(0.208)	1.179	(0.364)	0.854	(0.191)
GDP/cap+	0.805*	(0.073)	0.825	(0.129)	0.695	(0.138)	0.785	(0.147)
WGI	1.088***	(0.018)	1.081*	(0.034)	1.263***	(0.053)	1.014	(0.038)
Export+	1.004	(0.033)	1.004	(0.073)	0.984	(0.074)	0.935	(0.056)
Ex-colony	2.195***	(0.304)	0.045*	(0.067)	0.363	(0.271)	0.724	(0.355)
Eastern and South-Eastern Asia	1.253	(0.190)	2.502**	(0.733)	2.549*	(0.993)	1.736*	(0.483)
Europe	0.995	(0.242)	1.209	(0.655)	0.958	(0.542)		
Latin America and the Caribbean	1.843***	(0.295)	0.604	(0.156)	2.225*	(0.847)	0.427*	(0.160)
Northern Africa and Western Asia	1.485	(0.328)	0.391*	(0.155)	0.51	(0.283)	0.801	(0.409)
Oceania	0.813	(0.390)	1.301	(0.557)	1.513	(1.342)	1.835	(0.788)
Sub-Saharan Africa	0.936	(0.262)	0.272**	(0.137)	0.515	(0.358)	2.215	(1.903)
General development aid+	1.739***	(0.040)	1.761***	(0.085)	1.835***	(0.113)	1.809***	(0.102)
Population+	0.378***	(0.016)	0.427***	(0.038)	0.566***	(0.055)	0.436***	(0.044)
(Intercept)	952.325***	(788.011)	57.345**	(87.442)	3.348	(6.200)	178.014**	(315.418)
AIC	15192.115		3900.001		2428.527		1331.17	
BIC	15340.008		4015.258		2532.568		1421.243	
Log Likelihood	-7572.0574		-1926.0004		-1190.2633		-642.58498	
Observations	3506		900		564		371	
Groups (donors)	22		2		2		2	
Random intercepts (donors)	0.863	(0.143)	0.410	(0.223)	0	0	0	0

Notes: * p<0.05, ** p<0.01, *** p<0.001, +Logged values; yearly data lagged by one year; year dummies included but not shown; standard errors in parentheses.

Tables 5 and 6 show the regression results for the dependent variable with a full set of donor countries, listing the results of the selection and allocation stage of the two-parts model, respectively, for principal and discounted adaptation aid per capita. Each part consists of four models. The first model includes all factors I adjust to explain all types of donors' motivation on adaptation aid distribution decision. The second model is to capture donors' behavior on recipient country's physical vulnerability to climate change represented by the ND-GAIN index while the third model focuses on how donors react on recipient merit. The last model represents donors' motivation on their interest. These four models all include control variables that are total general development aid that is bilaterally reported in the given year and the population size of the recipient country.

On the other hand, Tables 7 and 8 show more specific results by geologically separated donors. Regional donor groups are split into four parts: Europe, Asia, North America, and Oceania. In this way, tables 7 and 8 are provided to interpret the donors' motivation in the same way as Tables 5 and 6 but provide a more detailed picture showing different traits of the donors' behavior by region.

4.1 Discussion of Results

4.1.1. Recipient need (H-1)

Is it indeed observed that the globally accorded notion that is to mobilize financial assistance to enhance climate change adaptation capacity in vulnerable countries? According to the result of Tables 5 and 6, donors seem to take care of developing countries that face climate change vulnerability. In the aggregated view, when the recipient country's vulnerability index increases, whether they get climate change adaptation finance and the amount they get tend to increase significantly. When the model is separated by donor region, all donors turn out to distribute more adaptation aid to more vulnerable countries in terms of both probability and amount, excluding Oceania donors. Thus, the H1, the more vulnerable a country to the adverse impacts of climate change, the more adaptation aid it should receive, is confirmed as statistically significant.

4.1.2. Recipient need (H-2)

What picture is drawn by recipient need in terms of adaptative capacity of recipient country represented by each dummy of Africa, SIDS, LDC, and the continuous variable of recipient GDP? Results from the regression table show mixed outcomes between variables to test adaptive capacity of recipient country. First, African countries and SIDre likely to get adaptation aid from donor countries than other countries at the selection stage while least developed countries are not in the case at the aggregated donor model. SDIS, however, shows negative and significant with adaptation aid. Interpretation of result on SIDS should be careful since it does not mean that SIDS are not likely to be selected more than other countires, but rather that they are less selected among countries with same vulnerability level. Once the donors decide where to give, however, other factors seem more important. At the allocation stage, whether recipient countries are in the group of African countries and SIDS, LDC does not affect the donors' behavior. When donors are separated as regions, only the Oceanian donors take care of small Island developing countries while African countries are only concerned by Northern American donors on average at the selection stage. Once recipients are selected, however, African countries have more possibility to get more adaptation aid from Asian donors while Small Island Developing countries have the probability to get more aid from Northern American and Oceanian donors. Unfortunately, Least Developed Counties are not likely to get more adaptation aid from none of the donors.

GDP per capita, which represents the recipient's economic level, shows different results at each stage. At the selection stage, donors seem to be concerned about the efficient use of adaption aid but at the allocation stage, the GDP per capita of the recipient country is considered by donors as other literature suggests. When the donors are divided by the regional specification, however, GDP per capita, which is only important to Asian donors and northern American donors, is affected negatively at the selection stage, whereas European donors care about GDP per capita at the allocation stage. When a donors' behavior is looked through by the governance index represented by WGI, the recipient country's WGI score does not matter at the selection stage but this is not the case in the allocation stage. This implies that donors do

consider the efficient use of aid money when resources are allocated among selected recipients. The donor region that is concerned most about the efficient aid money at the selection stage were the Northern American donors. At the allocation stage, all donors excluding Oceanian donors take care of the governance score of recipient countries.

4.1.3. Donors' interest

Do donors make use of aid distribution behavior for the purpose of promoting their economic activity? According to the evidence that is the result of total export flow from donor to the recipient shown in tables 5 and 6, whether the export amount from donor to recipient is the motivation of donor to allocation climate change adaptation aid has mixed results in each stage of the model. The export amount from donors to the recipient country does not seem as a motivation for donors to allocate climate change adaptation aid at the selection stage, so the more export amount flow from donor to recipient, the less possibility of climate change adaptation flows from donors to recipient. However, once the recipient is selected, donors tend to take account of their export flow when they allocate climate change adaptation aid. However, for the regionally grouped donor model, results are only significant in the European donors at the allocation stage with a negative relationship between climate change adaptation aid and export flows.

Regarding the colonial relationship between donor and recipient, recipient countries that once have been a colony of the donor country are more likely to have a chance of receiving climate change adaptation finance and get more adaptation aid at the allocation stage as well. This result is mixed by European and Asian donors, which shows a positive relationship with European donors and a negative relationship with Asian donors at the selection stage, but once donors decide where to give, the result becomes positive with Asian donors as well.

What about the regional distribution of climate change adaptation aid? Has it flowed evenly to the region as the impact of climate change? Unfortunately, results show the uneven distribution by recipient region. According to the result of the aggregate model, countries in Eastern and South-Eastern Asia, Latin America,

and the Caribbean are more likely to be selected as a recipient by donors, while European and Sub-saharan African countries are less likely to be selected than Central and Southern Asian countries. At the allocation stage, only countries in Eastern and South-Eastern Asia and Latin American and Caribbean countries tend to receive more climate change adaptation aid. Models by donor region also show that recipient region differs by donor region.

4.1.4. Control variables

The general development aid amount flows from donor to recipient countries that are introduced as a control variable shows different results at each of the stages. At the first stage, general development aid amount does not affect to donors' decision on whether to distribute climate change adaptation aid to the recipient, but at the allocation stage, the donors' behavior, as it turns out that they tend to give more climate change adaptation aid money to where they also give more general development aid money. The population of recipient countries also shows different results at each of the stages with statistically significant results.

5. Conclusion

The specific interest of donors in the recipient region, does it indeed have the possibility to affect to donors' motivation on climate change distribution? Analysis in this paper suggests that regional donor-recipient pairs affect the distribution of climate change adaptation finance, increasing concerns on recipient countries left behind.

Global climate change finance flows to developing countries in accordance with the notion that developed countries should provide finance to assist in enhancing developing countries' climate change adaptation capacity, considering their physical and economic vulnerability measured by the ND-GAIN vulnerability index and GDP per capita. Our findings, however, suggest that donors still might consider other factors as

they do in general development aid distribution to a different extent by donors. Regional aid distribution from donors to recipient shows the region where the aid might not be enough as shown in Figure 1 and 2.

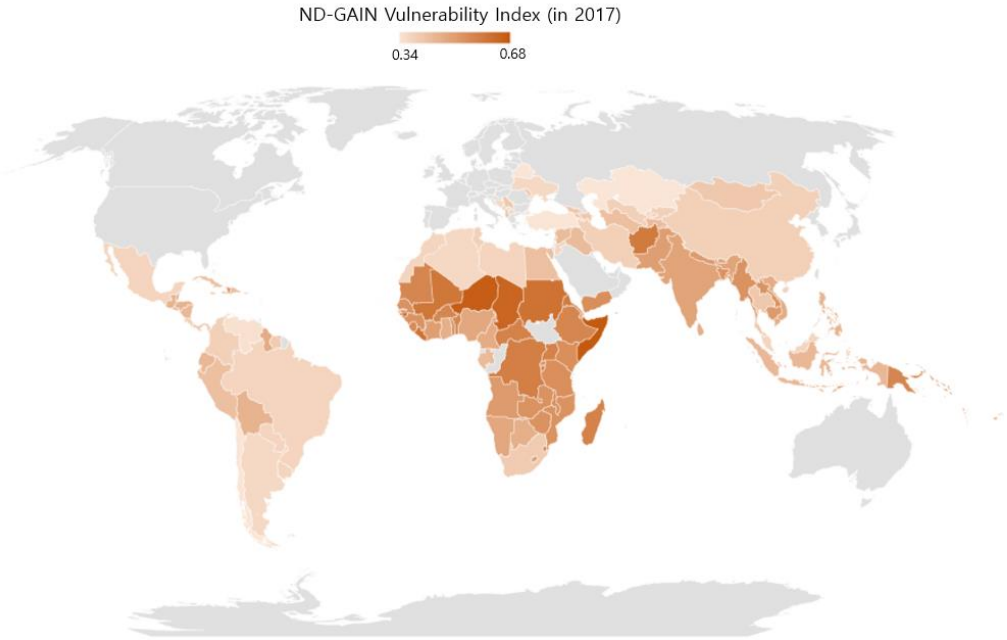


Figure 2. ND-GAIN index of recipient countries in 2017

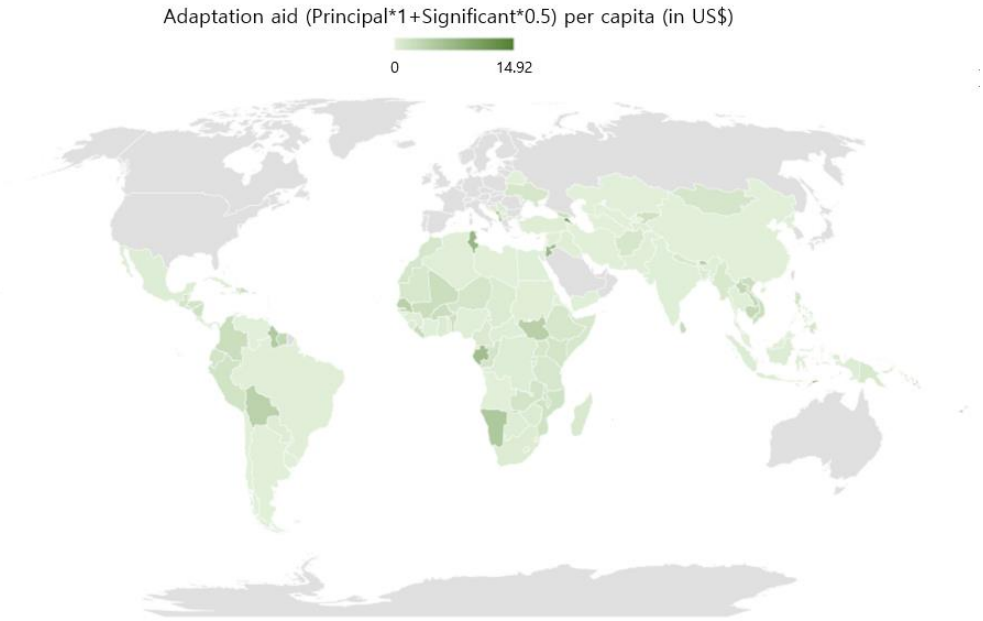


Figure 3. Amount of Adataion aid flows to recipients by all donors from 2012 to 2017

In this paper, vulnerability, recipient merit, and donor interest are all reaffirmed to play a role in determining the distribution of climate change adaptation aid to some extent as other literature. This implies that financing resources from developed countries to enhance climate change adaptation capacity in developing countries may not result in desirable ways. With the different purposes and motivations of donor countries, there are increasing concerns with the scattered results that wipe out the genuine purpose to tackle "double inequality" in developing countries. In addition to the analysis on the donors' motivation, uneven regional distribution of the climate change adaptation aid is also strengthened by regional donor-recipient patterns. Considering that climate change and its negative impacts have no border and no exception, only with prevalent donors' behavior that are similarly observed in general development aid distribution, global efforts to tackle the negative impacts of climate change in vulnerable countries still have a long way to go.

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