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Measuring vulnerability to climate change to allocate funds for adaptation*

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Summary

Debates on climate finance have so far little addressed its allocation among developing countries. This chapter examines how the concessional funds for adaptation should be allocated. The principle is to allocate these funds to developing countries primarily according to the vulnerability to climate change which they are not responsible. It leads to a «Vulnerability based allocation" (VBA). To this end a physical vulnerability to climate change index (PVCCI) is proposed, as tentatively established by Ferdi: the index aggregates the physical impacts of climate change according to their main identifiable channels. The index is likely to be regularly updated. Its average level is given by groups of countries (LDCs, SIDS, LICs, LMICs…). To determine the allocation of adaptation funds this index should then be used in a simple formula also including the per capita income since countries are even less resilient to climate change they are poorer. The choice of the parameters of the formula will transparently express a consensus of the international community on the principles of allocation of the «adaptation credits» by country. A tentative simulation is proposed to show the relative share that each group of countries would receive (more than half for LDCs) and the ratio of the level of allocation per capita relating to its average for developing countries (high for the SIDS, as well as LDCs). Adaptation credits could be used by countries with accredited financial institutions to which they submit their adaptation programs or projects.

* draft of a chapter in preparation to be published in *Towards a Workable and Effective Climate Regime*, S. Barrett, C. Carraro, J. de Melo (eds), forthcoming

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1. Introduction: the geographical allocation of adaptation funds within "climate finance"

The discussions on financing responses to climate change in developing countries too often mingle separate issues. Indeed adaptation to climate change cannot be dissociated from economic development, or be designed regardless of mitigation of climate change, which is itself essential in development strategy. But these interactions are at the operational level. They do not cancel out the need to distinguish between the sources of funding respectively available for development, adaptation and mitigation, in particular between those which are concessional, and their justification.

For financing each of these three purposes two problems arise, firstly the mobilization of resources, secondly their allocation among recipient countries. The mobilization of the resources has so far held much more of the attention of negotiators and experts than their allocation (see Canfin and Granjean, 2015; Canfin et al., 2015; or Brender and Jacquet, 2015). The final declaration of the Conference of the United Nations on financing for development (Addis Ababa, July 2015) is revealing in this regard. Concerning climate finance, it recalls the commitment of developed countries to mobilize 100 billion dollars per year from 2020 "from a wide variety of sources to address the needs of developing countries", as well as the need for transparent methods for reporting climate finance (United Nations, 2015, No. 60). It welcomes the implementation of the Green Climate Fund, and the decision of its Board " to aim for a 50:50 balance between mitigation and adaptation over time on a grant equivalent basis and to aim for a floor of 50 per cent of the adaptation allocation for particularly vulnerable countries, including least developed countries, small island developing States and African countries "(ibid., No 61). The rule for sharing between adaptation and mitigation to be used for the Green Fund has not yet been decided fototality of the 100 billion. The same holds for the aim of a minimum of half for vulnerable countrie

It is assumed here that the total amount of climate resources mobilized for developing countries is a given (see Massetti, 2015, and Buechner and Wilkinson, 2015), as well as the sharing of these resources between mitigation and adaptation. It is assumed also that it has been decided that the share will be provided in a concessional manner, and that concessional resources will be additional to those already mobilized for development.

Using these assumptions we examine how concessional resources for adaptation should be allocated among developing countries. This chapter first presents the principles the allocation should meet, and stresses the need to take into account the vulnerability to climate change of each country (section 2). It then discusses the nature of the vulnerability to be considered and proposes a new index independent of the country political choices (section 3). Finally it discusses how the principles can be implemented and the index be used in a global allocation system for adaptation funds (section 4).

2. Principles of allocation of climate change adaptation funds among developing countries: specificity of adaptation

For climate change adaptation funds, like for development assistance, three principles of allocation must be combined: effectiveness of the use of the funds with regard to the objective, equity in their distribution between countries, and transparency. To allocate the funds in a multilateral framework transparency can be sought through an allocation formula which expresses the consensus of stakeholders. This has been done by the multilateral development banks (MDB) with the "Performance Based Allocation" (PBA). It is a formula which leads to an allocation of the available resources on the basis of a predominant performance indicator[1], as well as income per head, a low level of which expresses a country's needs. The application of this formula has seen many changes, complications and exceptions, which have been criticized, and much reduce the transparency of allocation (see in particular Guillaumont and Guillaumont Jeanneney-Wagner, 2015; Guillaumont and Wagner, 2015; Kanbur, 2005). For the allocation of adaptation funds among developing countries it is possible to use a different formula which ensures transparency while preventing the criticism received by the PBA.

2.1. Allocation for mitigation and allocation for adaptation: two rationales

It is not possible to simultaneously determine the desirable geographical allocation of funds for adaptation and funds for mitigation because their objectives are different.

Mitigation of climate change largely corresponds to the production of a global public good. It must be implemented in individual countries, but in the interest of the whole planet. The effectiveness is mainly assessed here in terms of avoided CO2, rather than in terms of development of the countries where mitigation is implemented. With regard to effectiveness the corresponding funds should be used where mitigation opportunities are the biggest (discussion in Massetti, 2015). However, granted on a concessional basis to poor countries, these credits can also help them to implement a strategy of clean development, for example funds for the maintenance of tropical forests (Angelsen, 2015). This criterion of needs can be satisfied by a simple condition of eligibility or by a modulation of concessionality according to income per head.

On the contrary adaptation concerns each country individually, and the funds it receives for adaptation are supposed to be used for its own development. They can be channelled in different ways and according to specific criteria, but their use cannot be dissociated from that of development assistance. There is therefore a risk of fungibility undermining the additionality of resources. It is the specificity of the criteria applied to the allocation of adaptation funds that allows them to be differentiated from the other flows for development.

[1]Derived mainly from CPIA (Country Policy and Institutional Assessment) a composite index used by the MDB.

2.2. Adaptation: the ethical basis of a criterion of vulnerability to climate change

The specificity of vulnerability to climate change is obviously that most poor countries facing it are not responsible for it[2]. This vulnerability constitutes an allocation criterion for meeting the principle of equity (or need) which is without equivalent. There may be a precedent in the allocation of official development assistance (ODA), where structural economic vulnerability is sometimes considered as one of the possible allocation criteria. But for vulnerability to climate change the justification is stronger, for two reasons. Firstly, and most importantly, there is a moral debt of the developed countries responsible for the climate change to those who suffer from it. Birdsall and de Nevers (2012) speak of a 'causal responsibility', which creates an 'entitlement' for countries affected by climate change. Secondly, as will be seen below, it is possible to design a vulnerability index more clearly independent of the country's own choice than the one commonly used to measure structural economic vulnerability, namely the Economic Vulnerability Index (EVI) of the United Nations.

Even if the idea of using an index of vulnerability to climate change as a criterion for allocation of funds for adaptation was first presented in conjunction with the use of structural economic vulnerability as a criterion for allocation of ODA (Guillaumont 2008, 2009, 2015), it is independent, because of its ethical basis. It was proposed by Ferdi (Guillaumont and Simonet, 2011, 2014) and by the Center for Global Development (CGD) (Wheeler, 2011; Birdsall and De Nevers, 2012), as well as in various works prepared for the *World Development Report 2010* (World Bank, 2010; Barr, Fankhauser, Hamilton, 2010; Füssel, 2010), although these various work do not converge on the way to assess the vulnerability to take into account allocation[3].

3. An index of vulnerability to climate change as a criterion for allocation of the adaptation funds

3.1. What kind of indicator for measuring vulnerability?

There are many indices of vulnerability to climate (change?)[4]. But not being designed for this purpose they generally do not meet the requirements for serving as a criterion for the allocation of adaptation resources.

Firstly the index must be independent of the policy of the country. If the country's policy leads to a reduction of vulnerability, by increasing the capacity for adaptation, i.e. the resilience, this should not be a reason to reduce the allocation. Indeed vulnerability includes two components which logically impact on the allocation, but in opposite directions: truly exogenous vulnerability, which results from a shock suffered by the country and for which it is not responsible, unquestionably deserves external support; this is not the case for the vulnerability that the country could reduce by

[2]As noted by, among others, Kaudia (2015) who highlights the importance of adaptation for poor countries.
[3]The few works since devoted to this topic seem to have been about the allocation of resources from the Green Fund, dealing simultaneously with mitigation and adaptation (Polycarp et al. 2013), or dealing separately with adaptation (Noble 2013), but without using a quantitative criterion of vulnerability to climate change.
[4]Survey in Fussel, 2010; Guillaumont, Sarmiento and Closset, 2015; Miola et al. 2015

improving its ability to adapt. Good political resilience[5], which lowers vulnerability, could be a possible criterion of performance, if it is considered useful to have such a criterion. This distinction applies in particular to the resilience, which results both from structural factors, such as per capita income or human capital, generally taken into account separately in the allocation process (their low level resulting in more support), and resilience policy, whose weakness may lead to less support. Most of the available indices mix the two types of vulnerability, which of course enables them to offer a broad view of country vulnerability, but makes them inappropriate for allocation[6].

Secondly, and for similar reasons, it does not seem possible for international comparison and allocation to use vulnerability indices corresponding to an assessment of the economic damages expected from climate change[7]. Considerable progress has been made in the assessment of these damages, as evidenced in the review of the "New Climate-Economy literature" by Dell, Jones and Olken (2014). Chapter (XX) of Hallegate et al. provides examples. However these estimates are inevitably debatable and partial, as stressed by the authors. For example, agricultural production losses resulting from increased aridity in the distant future depend on not only the evolution of rainfall precipitation and temperatures, but also the evolution of techniques, research, and agricultural policies. In addition there is economic damage from climate change that is even more difficult to predict and measure (e.g. in the field of peace and security). Generally, damage estimates involve assumptions about adaptation policies that are specific to each country, and each country should make its own decision if the principles of ownership and alignment are to be met. Estimates of the costs of potential damages or adaptation carried out on a global scale are extremely useful for the global mobilization of resources, but they cannot serve as the basis for the allocation of adaptation credits between countries[8].

Thirdly the relevant vulnerability for allocation of adaptation funds, because of the above-mentioned ethical argument, is the vulnerability to climate *change*, not climate vulnerability in itself, which has always existed in various forms in different regions of the world. The initial "climate" vulnerability does not entail the responsibility of developed countries in the same way.

In short we propose to use a *physical* index of vulnerability to climate change that is *exogenous*, implies no socio-economic estimates, and captures in an adaptive way the impact of climate *change*, rather than climate. Since the index will reflect a change likely to continue, and the only non-debatable change is one that is observed (the prospects of which vary with the arrival of new observations), the index must be constantly updated.

[5]That can be translated into special measures such as external reserves, insurance mechanisms, etc.
[6]A significant example is given by the index ND-GAIN (University of Notre Dame Global Adaptation Index), April 2015.
[7]D. Wheeler (2011) refers to the agricultural productivity losses estimated by Cline, 2007, for the CGD.
[8]The World Bank highlights the fragility of the 'across countries' conclusions on the costs of adaptation (World Bank, 2010, p89).

3.2. A "Physical Vulnerability to Climate Change Index" (PVCCI)

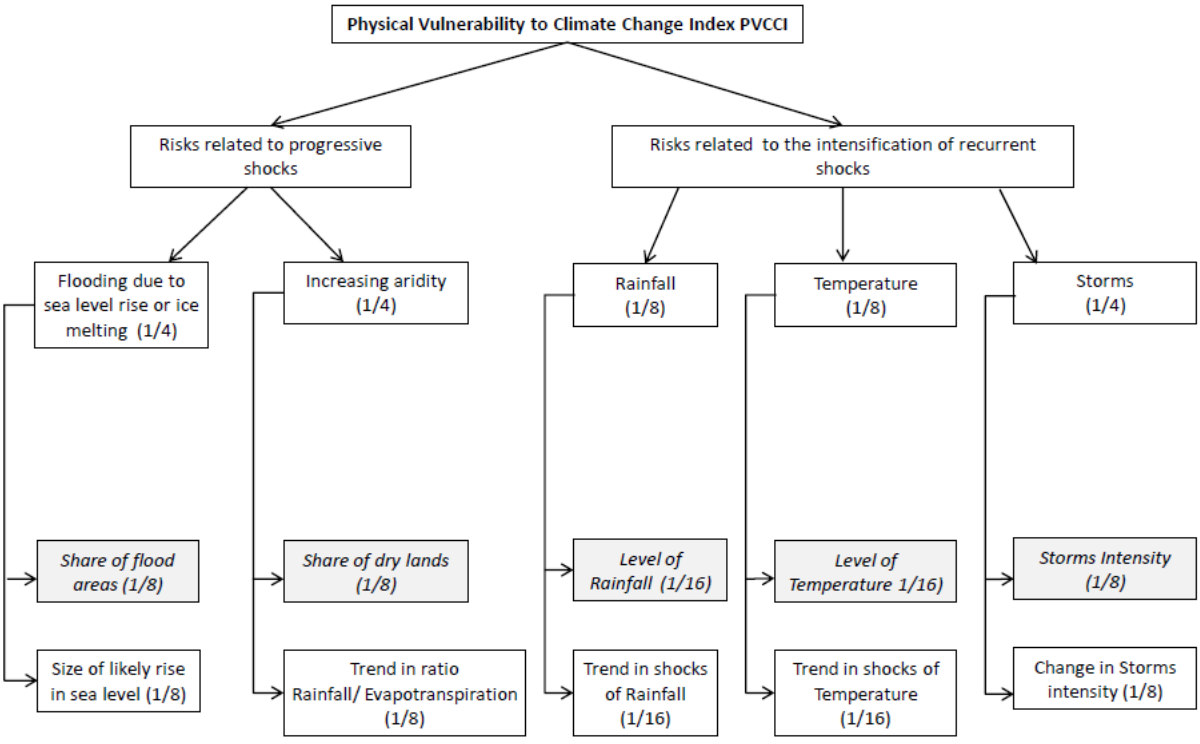
An indicator of vulnerability to climate change which meets the previous criteria (exogeneity of components, absence of socio-economic variables, focus on the impact of the change) was set up by Ferdi in 2011 (Guillaumont and Simonet, 2011) and subsequently revised on several occasions to use new data or bring methodological improvements (Guillaumont and Simonet, 2014; Guillaumont, Simonet, Chidinma, and Feindouno, 2015). It is a dynamic forward-looking indicator, although based on past data, and relies on a distinction between two kinds of risks which arise from climate change:

- risks related to *progressive shocks*, such as the rise in the sea level (risk of flooding), an increasing trend of temperatures, or a decreasing trend in rainfall precipitation (risk of desertification).

- risks associated with *the intensification of recurrent shocks*, whether rainfall shocks, temperature shocks, or cyclones.

For each of these two types of shock, the index, like the EVI, relies on a distinction between the size of shocks and the exposure to shocks. Since the sources of vulnerability are heterogeneous and the vulnerability of each country is specific, the indices corresponding to the various types of shocks are aggregated through a quadratic average, which gives more weight to those components which more reflect vulnerability.

Figure 1: Components of the Physical Vulnerability to Climate Change Index



NB. The boxes corresponding to the two last rows of the graph respectively refer to exposure components *(in italics)* and to size of the shocks components

In its current structure, the PVCCI does not include resilience, i.e. the capacity to adapt to shocks, since as outlined above, resilience is determined by two categories of factors that influence the allocation in opposite directions, structural factors (income per capita, human capital) and resilience policy.

3.2. Groups of countries most vulnerable to climate change

The Addis Ababa declaration welcomes the objective of the Green Fund to allocate half of its resources to "vulnerable countries", naming the LDCs, SIDS and African countries. For the consensus to operate it should rely on a quantitative assessment. Estimates of the index may indeed differ according to the method of calculation. The latest Ferdi estimates[9] do not evidence an average level of physical vulnerability to climate change for LDCs significantly different from that of other developing countries, but structural economic vulnerability (using the EVI index) is significantly higher, which is normal since EVI is a criterion for the identification of least developed countries. But the PVCCI does not include structural resilience, much lower in LDCs (and Africa), due to a lower level of human capital and income per head. LDCs are therefore especially vulnerable to climate change if we consider the "structural vulnerability" including the physical vulnerability and the structural factors of low resilience.

For the SIDS the average level of the PVCCI is slightly higher than that of other developing countries (and close to that of LDCs, which is not the case for EVI).

Table 1: Physical Vulnerability to Climate Change Index (PVCCI) by country group

Group of countries	Average	Median	St-Dev	Min	Max
Developing countries (108)	45.6	44.7	7.3	31.4	63.2
LDC (47)	46.0	42.2	7.2	33.2	59.0
Non LDC (61)	45.2	45.8	7.5	31.4	63.2
SIDS (24)	47.8	48.2	9.1	31.4	63.2
SIDS-LDC (10)	47.5	48.1	9.1	33.2	59.0
SIDS Non-LDC (14)	48.0	48.2	9.4	31.4	63.2

There is in fact a large spread of the score for the indices within each country category. This is a major reason for determining the allocation country by country on the basis of criteria such as the PVCCI rather than by category membership. We can then examine the results for each category.

[9] Calculation by SossoFeindouno at Ferdi

4. Implementation: design and use of "adaptation credits".

Now, assume that there is a consensus on an index of physical vulnerability to climate change, available for most developing countries. How can it be used for the allocation of adaptation funds? A consensus on an allocation formula is still needed, which from this index and other possible criteria, may determine an allocation of the total adaptation fund between countries. An "adaptation credit" would correspond to the "normal allocation" estimated for each country. On this basis a country could apply to various financial institutions through which the adaptation funds would be channelled.

4.1. Measurement of the "adaptation credits" from an allocation formula

The formula should express the simple idea that the adaptation funds must meet the needs of countries affected by climate change, for which they are not responsible and in the face of which the poorer they are the less capable they are.to cope with The formula should be based on two essential criteria, physical vulnerability to climate change and per capita income (and/or the level of human capital). The variables corresponding to the two criteria would be preferably introduced in a multiplicative function, in order to show the elasticity of the allocation to each criterion.

The model may seem akin to the PBA (*Performance Based Allocation*) that all the multilateral development banks use to allocate their concessional credits (cf. Guillaumont and Wagner, 2015). However it is different for two reasons. Firstly it includes an indicator of vulnerability, while the MDBs have not so far integrated economic vulnerability in their model[10]. Secondly, and most importantly, in the PBA the criterion of 'performance', essentially governance, plays a major role. Priority is given to effectiveness, more than equity. For the allocation of adaptation funds the priority is placed instead on equity, because of the ethical basis for the financing of adaptation. It is essential that the adopted measure of vulnerability to climate change represents a vulnerability for which they are not responsible, in order to justify the support of the international community. Per capita income is utilised to reflect the need for concessional adaptation resources, and its low level is a sign of low structural resilience.

This approach is similar to the point of view expressed by Birdsall and de Nevers (2012). But it differs from the way in which some authors, influenced by the PBA and giving a major weight to the "performance" measure, consider the allocation of funds for adaptation (Barr, Hamilton and Fankhauser, 2010; *World Bank,* 2010). The model proposed here is a *Vulnerability Based Allocation* (VBA), rather than a PBA.

Using the same calibrationof the variables as in the PBA model used by the MDBs and the same functional form, a model has been built from only three variables: a variable of low level of income

[10]An exception is the Caribbean Development Bank. The European Commission has recently used EVI for the allocation of assistance.

per head (AY), a measure of PVCCI (V), and the size of the population (P)[11]. The results of a simulation carried out for illustrative purposes[12] for a sample of 106 countries, with the latest version of the FERDI PVCCI and using the figures for per capita income and population in the year 2014, are given in the table below. They show :

1. in column (1) - the relative share of the allocation for LDCs, SIDS, low income countries (LICs), lower middle-income countries (LMICs), upper middle-income countries (UMICs), and Sub Sahara African Countries (SSA);

2. in column (2) - the relative share of the population in each group,;

3. in columns (3) and (4) - an index of the relative allocation per capita, respectively a weighted average, given by the ratio of (1) to (2), and a simple average (index > 1 if the allocation per capita is higher than the global average), with some indicators of the spread within each group (in columns (5) to (7)).

According to this simulation LDCs would receive more than half of the adaptation credit. The SIDS group would receive a level of credits per capita close to the average, due to the fact that many SIDS have a fairly high level of income per capita. When an exponent lower than 1 is applied to the population size, in order to reflect a lower resilience due to small size, the allocation per capita of the SIDS becomes higher than the average. Of course there is a wide range of scores for the index between countries.

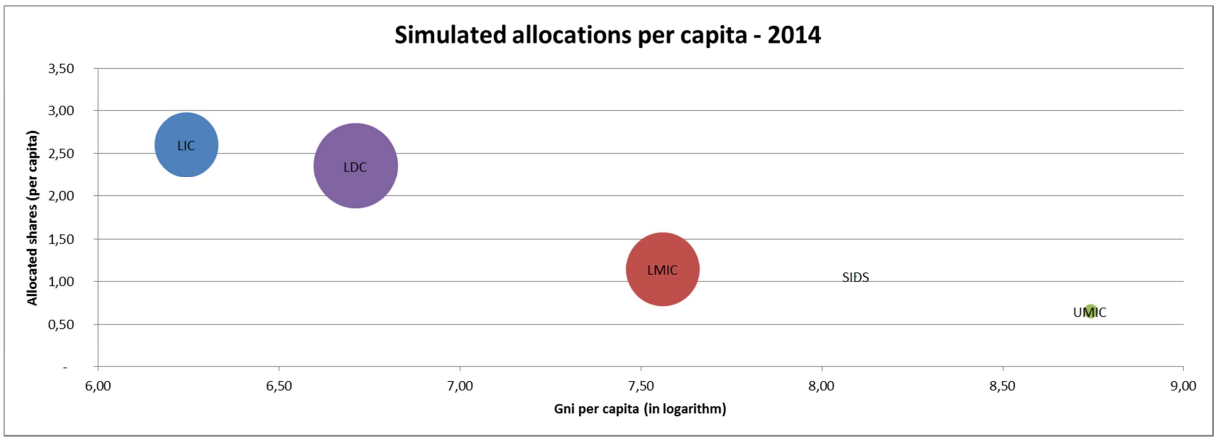
Table 2: Vulnerability Based Allocation (VBA) of adaptation resources, for 106 developing countries

	Share of allocated resources (%)	Share of total population (%)	Relative allocation per capita Weighted average	Relative allocation per capita Simple average	Relative allocation per capita Std. deviation	Relative allocation per capita Max.	Relative allocation per capita Min.
	(1)	(2)	(3)=(1)/(2)	(4)	(5)	(6)	(7)
LIC	42.22%	20.03%	2.11	2.60	3.12	10.14	0.15
LMIC	48.37%	49.38%	0.98	1.15	1.40	4.99	0.01
UMIC	9.41%	30.59%	0.31	0.65	0.73	2.63	0.00
LDC	55.75%	30.28%	1.84	2.36	2.74	10.14	0.02
SIDS	1.71%	1.77%	0.97	1.06	1.07	3.75	0.01

Figure 2 summarizes these observations by representing for each group of countries both the relative level of the allocation per capita as a function of GNI per capita, and by the size of the bubbles the relative share of the total allocation.

[11]According to the following formula: Allocation to country i = $P^a i. AY^b i. V^c i$.
[12]Simulations run by Laurent Wagner, FERDI (here with the following parameters: a = 1; b = 2;
c = 4). Simulations with a parameter a<1 are legitimate due to the structural resilience of small countries.

Figure 2. Relative allocation per capita for adaptation and GNI per capita (with a=1)



It should be underlined that the "normal allocations" are designated from continuous criteria and not from category membership. If LDCs receive half of adaptation credits, this is due not to a quota, but to their characteristics. Some LDCs may only be a little vulnerable to climate change and receive little credit for adaptation, while they may have a high economic vulnerability likely to lead to a relatively high level of ODA per capita. Middle-income non-LDCs may be highly vulnerable to climate change, so justifying a fairly high level of allocation for adaptation, without being eligible for a high level of ODA. In this regard the allocation of adaptation credits based on an indicator of vulnerability to climate change should help to achieve the 'smooth transition' wanted by the United Nations for the countries graduating from the LDC category, many of which are vulnerable to climate change.

Under the influence of donors, governance factors might be introduced in the model of allocation of funds for adaptation, with a positive sign, as a criterion of effectiveness or performance. A logical criterion would then be an indicator of resilience policy. But, as seen above, resilience related to the country's own willingness is difficult to measure. What would be the alternative measures? Could it be the general economic performance through a measure similar to that used for the PBA? Or the quality of the policy against global warming, which is a more relevant criterion of allocation for mitigation than adaptation? Or an evaluation of the portfolio of projects implemented in the country by foreign aid?

None of these options seems legitimate with regard to the ethical argument specific to adaptation stated above. Should adaptation credits to a fragile state be reduced due to bad governance related to its fragility? When using credits the quality of adaptation projects can be controled.

4.2. Use of adaptation credits by countries. Competition between the accredited bodies

How could a country use its 'adaptation credit '?

It seems to be agreed that a number of institutions will be accredited to receive additional climate resources from the international community (not only the Green Fund, but also the MDBs, UNDP, various bilateral development agencies). In the proposed system a developing country to which an

adaptation credit is allocated will be allowed to draw any part of this credit from the accredited institution of its choice. An international body (which may be the Green Fund) will be responsible for keeping an account of the allocations received by the accredited institutions and the drawings made from them. The total amount of adaptation credits would not exceed that of allocations. The allocations and the credits could be measured in terms of grant-element, so that projects can be implemented under the financial conditions which are the most appropriate in each case.

Each country holding an adaptation credit may thus present to the institution of its choice projects or adaptation programs. The accredited institution will ensure that it is a real adaptation project or program, then will analyse its modalities with the country, as it does for its other operations. Each country thus can use its adaptation credit through the institution that offers the best financial conditions and technical services.

In the above, we have assumed that from the volume of resources mobilized for adaptation what each accredited institution manages is determined on a discretionary basis by the adaptation fund donors. One might also imagine that the Green Fund, instead of becoming an additional institution for direct funding of adaptation projects or programmes, could intervene simply as a refinancing body for the accredited institutions or as a subsidizing instrument for eligible projects or programmes. Accredited institutions would then receive their resources partly and discretionarily from bilateral sources, and partly (or only, if so decided by the international community) through the Green Fund, depending on the quality of programmes and projects that are submitted. Consistency with development programmes and projects would be achieved at the operational level by the accredited institutions, which are skilled in the art. Compliance with the objective of adaptation would be achieved through the mode of financing, in particular the Green Fund, whose function for adaptation would then be redefined.

The use of funds described above for the adaptation process is legitimate only if donors are willing to ensure that mobilized funds are used to adapt, regardless of the risks of fungibility. The contribution of developed countries should be based on the responsibility of each one for global warming. The previous proposal only aimed at allocating the amount of additional resources that will be mobilized for adaptation by the international community. Donors can of course provide more adaptation resources than that to which they will be committed. They will be all the more inclined to do so since their development assistance, without being reduced, will be adapted to climate change.

References :

- Angelsen, A. (2015) "REDD+: what should come next?", *Towards a Workable and Effective Climate Regime*, S. Barrett, C. Carraro, J. de Melo (eds), forthcoming
- Barr, R., S. Fankhauser, and K. Hamilton (2010) "Adaptation Investments: A Resource Allocation Framework | Grantham Research Institute on Climate Change and the Environment." *Mitigation and Adaptation Strategies for Global Change*, Springer, 15 (8): 843–858.
- Birdsall, N., and M. de Nevers (2012) "Adaptation Finance, How to Get Out from between a Rock and a Hard Place." *CGD Policy Paper* PP 001. Washington DC: Center for Global Development. http://www.cgdev.org/sites/default/files/1425965_file_Birdsall_de_Nevers_Adaptation_Finance_FINAL_0.pdf.
- Brender, A. et P. Jacquet (2015) « Comment « financer le climat » ?», in Mistral, J. *Le climatva-t-il changer le capitalisme ? La grande mutation du XXIe siècle*. Paris: Eyrolles, pp. 121-134. http://www.eyrolles.com/Loisirs/Livre/le-climat-va-t-il-changer-le-capitalisme-9782212562439
- Buchener, B. and J. Wilkinson (2015) "Pros and cons of alternative sources of climate change financing and prospects for 'unconventional finance", *Towards a Workable and Effective Climate Regime*, S. Barrett, C. Carraro, J. de Melo (eds), forthcoming
- Canfin, P., and A. Grandjean. (2015) "Mobiliser Les Financements Pour Le Climat." Paris. http://www.elysee.fr/communiques-de-presse/article/rapport-mobiliser-les-financements-pour-le-climat-de-pascal-canfin/.
- Chen, C., I. Noble, J. Hellman, M. Murillo, and N. Chawla (2015) "University of Notre Dame Global Adaptation Index Country Index Technical Report." USA: University of Notre Dame. http://index.nd-gain.org:8080/documents/nd-gain_technical_document_2015.pdf.
- Cline, W- R. (2007) *Global Warming and Agriculture: Impact Estimates by Country*, Washington, DC: Center for Global Development and Peterson Institute for International Economics.
- European Commission. 2015. "Workshop on 'Indicators and Data for Climate Resilient Development: From Data to Information and Knowledge to Policy Actions.'" Brussels: JRC Science Hub - European Commission. https://ec.europa.eu/jrc/en/event/workshop/indicators-and-data-climate-resilient-development.
- Füssel, H-M. (2010) "Review and Quantitative Analysis of Indices of Climate Change Exposure, Adaptive Capacity, Sensitivity, and Impacts", Background Note for the *World Development Report. Development and Climate Change*
- Green Climate Fund. 2015. "Analysis of the Expected Role and Impact of the Green Climate Fund." GCF/B.09/06. Korea: Green Climate Fund. http://www.gcfund.org/fileadmin/00_customer/documents/MOB201503-9th/06_-_Analysis_of_the_Expected_Role_and_Impact_of_the_Green_Climate_Fund_20150228_fin.pdf.
- Guillaumont, P. (2008) "Adapting Aid Allocation Criteria to Development Goals. An Essay for the 2008 Development Cooperation Forum, UN ECOSOC", May 2008*, FerdiWorking Paper*

- Guillaumont, P. (2015) "Measuring Structural Vulnerability to Allocate Development Assistance and Adaptation Resources." March, *FerdiWorking Paper*, no. P68. http://www.ferdi.fr/en/publication/p68-measuring-structural-vulnerability.
- Guillaumont, P., S. Guillaumont Jeanneney and L. Wagner (2015) "How to take into account vulnerability in aid allocation criteria and lack of human capital as well: improving the performance based allocation", October 2010*, FerdiWorking Paper*, n°13, revised January 2015
- Guillaumont, P. and C. Simonet (2011) "Designing an Index of Structural Vulnerability to Climate Change, Mars, Ferdi*Working Paper,* I 08
- Guillaumont, P. and C. Simonet (2014) "Facing Climate Change in the LDCs: How to Fit the Istanbul Programme of Action" in LDC IV Monitor, *Istanbul Programme of Action for the LDCs (2011-2020). Monitoring Deliverables, Tracking Progress-Analytical Perspectives,* Commonweath Secretariat, pp. 287-317
- Guillaumont, P., C. Simonet, M. Closset and S. Feindouno. (2015) "An Index of Physical Vulnerabilty to Climate Change, Who Are the Most Vulnerable Countries?", *FerdiWorking Paper*, forthcoming
- Guillaumont, P. and L. Wagner (2015) "Performance Based Allocation (PBA) of Foreign Aid: Still Alive?", in M. Arvin (ed.), *Handbook on the Economics of Foreign Aid*, Cheltenham, UK: Edward Elgar, forthcoming.
- Kanbur, R. (2005) "Réformer la formule :unemodeste proposition pour inclure des critères de résultatsdans les procéduresd'allocation de l'aide de l'IDA", *Revue d'économie du développement2005/2 (Vol. 13), p238.*
- Massetti, E. (2015) « The Macroeconomics of Climate Policy: Investments and Financial Flows", *Towards a Workable and Effective Climate Regime*, S. Barrett, C. Carraro, J. de Melo (eds), forthcoming
- Miola, A., V. Paccagnan, E. Papadimitriou, and A. Mandrici (2015) "Climate Resilient Development Index: Theoretical Framework, Selection Criteria and Fit for Purpose Indicators." *Report EUR 27126 EN*. Joint Research Center.
- Kaudia, A-A. (2015) "Policy options in low-income countries: Achieving socially appropriate climate change response objectives", *Towards a Workable and Effective Climate Regime*, S. Barrett, C. Carraro, J. de Melo (eds), forthcoming
- Noble, I. (2013) "Options for Resource Allocation in the Green Climate Fund (GCF): Possible Allocation Principles and Criteria – Adaptation" Background Paper 3, *Options for Resource Allocation in the Green Climate Fund*, Climate Analytics. http://climateanalytics.org/files/gcf_allocation_options_background_paper_3.pdf
- Polycarp, C., A. Douglas, N. Bird, and M. Birjandi-Feriz. (2014) "Making the Green Climate Fund's Allocations Add Up to Its Ambition." Working Paper. Climate Finance Series. World Resouces Institute. http://www.wri.org/publication/green-climate-fund-allocation.
- United Nations. 2015."Outcome of the Third International Conference on Financing for Development: Addis Ababa Action Agenda" A/CONF.227/L.1
- Westphal, M., P. Canfin, A. Ballesteros, and J. Morgan. (2015) "Getting to $100 Billion: Climate Finance Scenarios and Projections to 2020" *World Resources Institute Working Paper*.

http://www.wri.org/publication/getting-100-billion-climate-finance-scenarios-and-projections-2020.

- Wheeler, D. (2011) "Quantifying Vulnerability to Climate Change: Implications for Adaptation Assistance." Working Paper 240. http://www.cgdev.org/publication/quantifying-vulnerability-climate-change-implications-adaptation-assistance-working.
- World Bank (2010) "Economics of Adaptation to Climate Change - Synthesis Report." 70267. Washinton DC: The World Bank. http://documents.worldbank.org/curated/en/2010/01/16436675/economics-adaptation-climate-change-synthesis-report
- World Bank (2010) *World Development Report2010 : Development and Climate Change* Washington, DC

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Pascal

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