



**Measuring vulnerability to climate change
to allocate adaptation resources**

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Why measuring a country « exogenous » vulnerability

- Vulnérabilité is handicap to sustainable development
- Opposite to sustainability
- At the heart of the post-2015 agenda
- To a large extent it is exogenous and structural
- With several dimensions
- Legitimates support from the international community

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Vulnérabilité on the international agenda

- Identification of the *Least Developed Countries* (LDCs) as low income countries suffering from low human capital and high economic vulnerability (explicit since 2000)
- *Small Island Developing States* (SIDS) high concern about vulnerability, reflected at the Barbados (1994) and Mauritius (2004) Conferences...
- Increasing concern about *fragile states*
- Awareness of vulnerability with the « *multiple crises* » of the end of 2000s: oil prices, food prices, world demand downturn
- Growing concern about expected consequences of *climate change*
- *More generally link with the pos-2015 agenda on sustainable development*



(Vulnerability and sustainability)

- Goals of sustainable development cannot be designed and pursued without considering the corresponding vulnerabilities (vulnerability is a risk on sustainability)
- Consistent with a universal agenda of sustainable development: taking into account vulnerability in its various dimensions (economic, social, environmental), and paying special attention to countries vulnerable for these various reasons, such as LDCs, LLDCs and SIDS
- Economic vulnerability threatens the sustainability of economic growth and its *inclusiveness*, as does political or state fragility, itself to a large extent an outcome of structural economic vulnerability
- For environment, vulnerability is the opposite of environmental sustainability, as it clearly appears with climate change
- Easier to have indicators of vulnerability than indicators of sustainability



Vulnerability semantics

- Vulnerability, at the *macro* level (as at the *micro* level) is the risk to be hampered by exogenous shocks, either natural or external (...)
- It depends on the *size of the shocks*, the *exposure* to these shocks and the capacity to cope with them, also said capacity to adapt or *resilience*
- *Structural vulnerability* is the vulnerability that does not depend on the country present will, but is determined by exogenous and lasting factors (of the three components)
- *General vulnerability* also depends on the country present and future will, that is more rapidly changing, in particular through the resilience component
- Distinctions valid for various kinds of shocks and vulnerability



(Les effets négatifs de la vulnérabilité structurelle)

- For *economic growth*, due to many reasons, corresponding either to risk or to asymmetry effects of economic instability
- Even more for *poverty reduction*, because instability makes economic growth, already affected by vulnerability, less pro-poor
- For *policy*, because the quality of policy and institutions is affected by structural vulnerability
- For *sustainability* in its various dimensions, economic, social, environmental (vulnerability is the opposite of sustainability) , and their inter-relations: economic shocks have environmental consequences, and environmental shocks have economic consequences
- Need for an international response to structural vulnerability



**Two related issues to be discussed
focussed on the vulnerability to climate change**

1. How to design *structural* (versus general) vulnerability indicators, not depending on present policy:
 - recall: the economic vulnerability index (EVI)
 - focus: the *physical vulnerability to climate change index (PVCCI)*
2. Why and how to use such two indicators as criteria for the international *allocation* of (concessional) resources:
 - recall: economic vulnerability, for ODA
 - focus: PVCCI for the *allocation of the adaptation resources*



(I)

Définir des indices de vulnérabilité structurelle

- To be used for the allocation of resources, indicators should not depend on present policy, as for the identification of countries durably deserving a special attention (such as the LDCs)
- They should primarily reflect both the likely size of the shocks and the exposure to these shocks
- They should capture either an economic medium-term vulnerability or a long term physical vulnerability to climate change
- Focus on two indicators already calculated as indices
 - EVI: the economic vulnerability index (UN CPD)
 - PVCCI: a physical vulnerability to climate change index (Ferdi)



The structural economic vulnerability as measured by the Economic Vulnerability Index (EVI)

- Designed by the UN CDP for featuring LDCs, EVI has been set up first in 2000, then revised, mainly in 2005, then slightly in 2011
- Captures only structural components of vulnerability, chosen with regard to their expected (or evidenced) effect on economic growth
- Transparent and parsimonious, EVI relies on
 - 4 main (structural) exposure components (ex ante vulnerability)
 - and 3 (exogenous) shock components, measuring past recurrent shocks, likely to re-occur in the future and to already hamper future economic growth



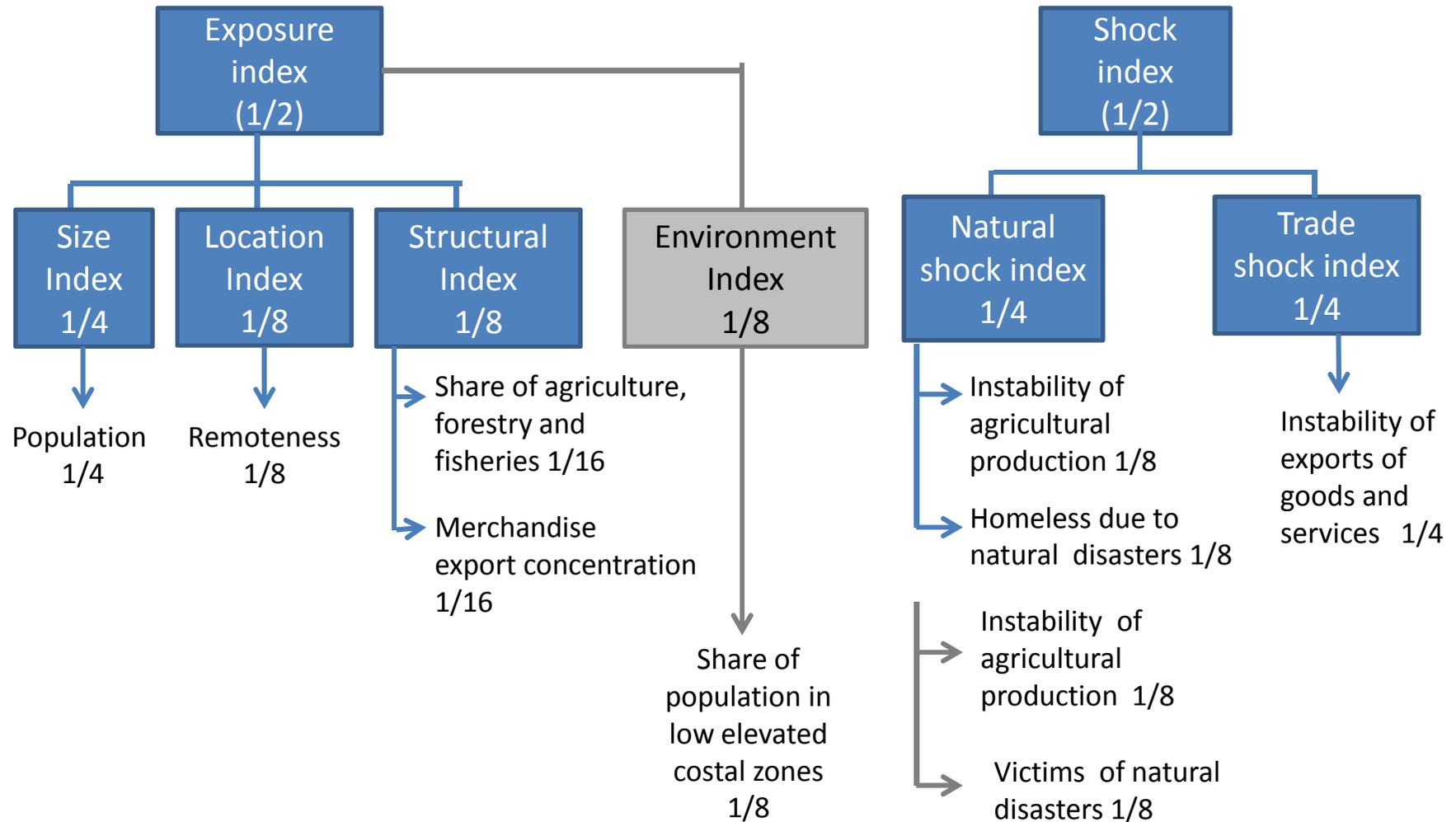
Changes recently brought in EVI ...and challenges

- Changes brought in 2011 for the 2012 review
- Same structure, but
- Among shocks components, homeless population due to natural disasters replaced by population affected (« victims »)
- And a new exposure component added ,
the % of population living in low coastal area,
same weight now given to each of the new 4 sub-components
- *Means a small move to make LDCs countries meeting structural obstacles for sustainable development, rather than only for growth*
- But addition unbalanced with respect to dryland countries
- Relevance of the distinction between economic vulnerability and climatic vulnerability, besides another one
between economic vulnerability and state fragility



Economic Vulnerability Index (EVI)

■ 2005
■ 2011





(High and lasting structural vulnerability in LDCs, according to EVI)

- The *Economic Vulnerability Index* (EVI), progressively set up by the CDP in 2000- 2005 for the identification of LDCs, slightly revised in 2011, balancing shock and exposure components, naturally evidences the high vulnerability of the LDCs
- According to the figures used for the 2012 review of LDCs list,

	EVI	Exposure I.	Shock I.
LDCs	45.7	42.3	49.2
ODCs	33	34.9	31.1
SIDS non LDCs	42.1	48.7	35.4
SIDS	46.2	52.5	39.8

- According to a *Retrospective EVI*, set up at Ferdi, *less decline* in LDCs than in ODCs and in other LICs, and due more to the shock components than to the exposure components



**Structural resilience kept aside...
or included in a broader concept of structural vulnerability**

- General vulnerability also depends on the capacity to react, indeed dependent on present policy (main part), but also (a minor part?) on structural factors, the structural resilience
- These structural factors of resilience are broad factors, to a large extent captured by separate indicators, in particular GNIpc and the Human Assets Index (HAI), that with EVI are used as complementary criteria for the identification of LDCs
- Possible to include them in a broader concept of vulnerability , such as the SHI or LLDI index
- But would blur the specificity of the vulnerability concept



(Structural economic vulnerability and state fragility)

- Structural economic vulnerability, distinct from *state fragility*,
- Leads to clearly separate LDCs and fragile states (FS)
- State fragility conceptually designed only from present policy and institutional factors: lack of state capacity, political will and legitimacy (many changing definitions)...
- ...and often identified through a low level of the CPIA
- Structural economic vulnerability designed from factors (exogenous shocks and exposure) independent of policy
- But structural vulnerability influences state fragility:
 $CPIA = f(EVI, HAI, GNIpc)$
- And many LDCs are also FS (most are or have been so)

Economic vulnerability and vulnerability to climate change

- Vulnerability to climate already taken into account through several components of EVI (population affected by natural disasters, instability of agricultural production), and now more specifically by the risk to be flooded due to the sea level rise (an exposure component of vulnerability to climate *change*)
- But vulnerability to climate change differs from the economic vulnerability by its nature (more physical) and time horizon (longer): it reflects a long term *risk of change in geo-physical conditions*, not a structural handicap to economic growth in medium term
- And vulnerability to only one (major) environmental factor: other possible factors (eg earthquakes)
- And possible vulnerability of the environment itself (eg biodiversity) to various factors



Which index of vulnerability to climate change is needed

- Depends on the goal pursued (many indices available), here an index likely to be used (among others) to allocate resources for adaptation, with the idea to allocate more to the most vulnerable
- Should be independent not only of the current policy (as EVI), but also of future policy: countries more vulnerable because of a poor present or expected policy/resilience should not be rewarded for that
- Since vulnerability to CC is a quite long term one, it should preferably be captured through *physical* components
- This is the main feature of the recent Ferdi *Physical Vulnerability to Climate Change Index* (PVCCI), as such differing from other attempts (CGD 2011, Barr et al. 2010)

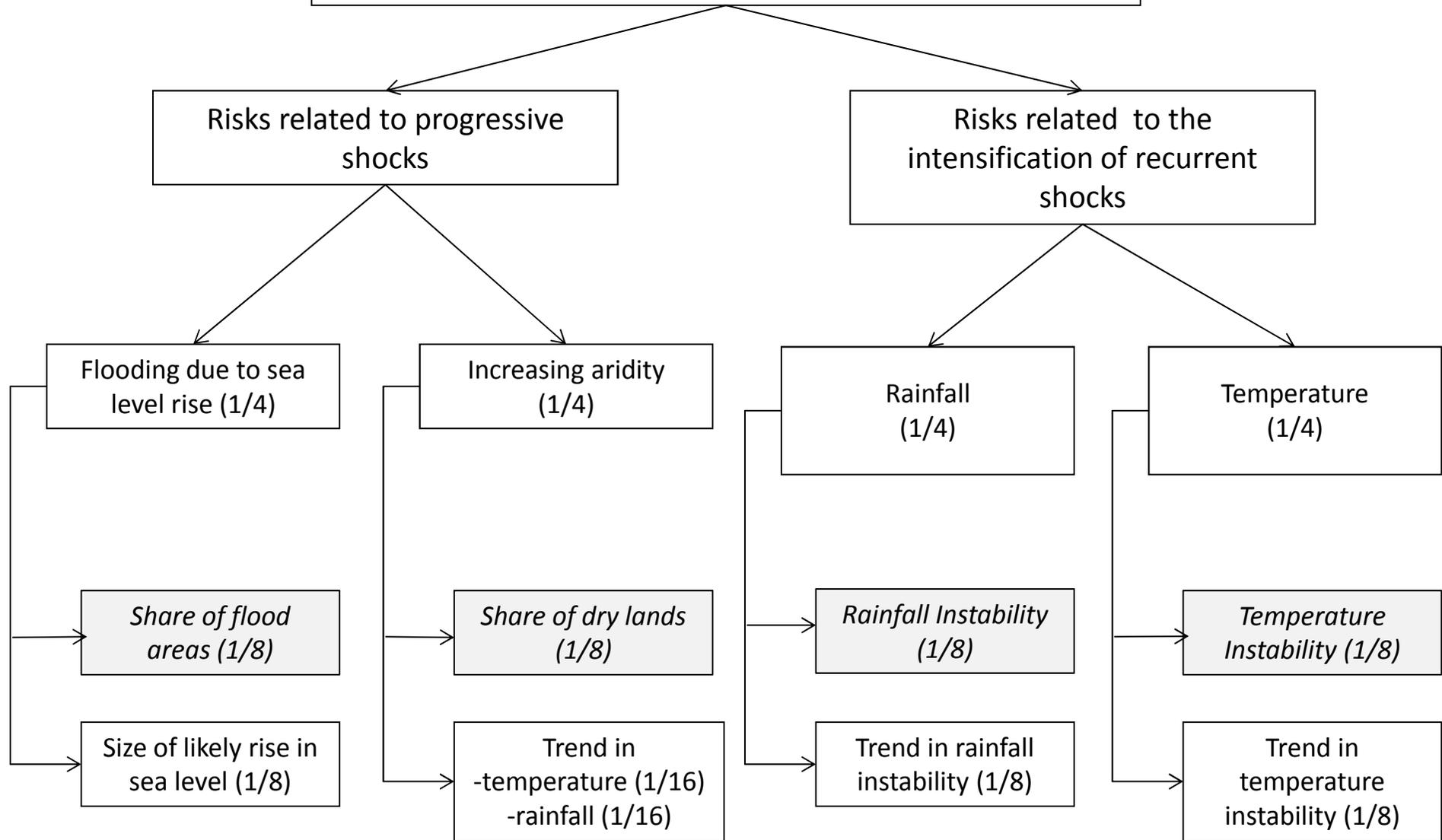


A physical vulnerability to climate change index: main features

- Forward-looking and likely to capture long term risks
- Relies only on geo-physical components, without any debatable socio-economic component
- So does not include components reflecting the adaptive capacity
- Makes a distinction between two kinds of risks due to climate change
 - risks related to *progressive shocks* (such as sea level rise) and
 - risks related to the *intensification of recurrent shocks* (in rainfall or temperature)
- Makes another distinction between the shocks and the exposure to the shocks, because the impact of the shocks depends on the initial exposure,
- And uses a geometric averaging to capture interactions
- Still tentative (and change in the data basis)



Physical Vulnerability to Climate Change Index PVCCI



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



Adaptive capacity and resilience, again kept aside

- (Weak) adaptive capacity often considered as a part of climate vulnerability indicators
- As economic resilience, it depends on various structural factors, and is not determined only by present policy factors
- But again these structural factors are very broad: including them would lower the specificity of the vulnerability concept
- Better to take them into account separately through indicators such as income pc or human assets index
- Indeed the same as for economic resilience with EVI



Mixing the two indices?

- There is a rationale for keeping two separate indices:
 - difference of time horizon
 - difference of scope (economic vs geo-physical impacts)
- But *fusion* in an extended structural vulnerability index, combining the two indices is conceivable (only one redundant component in EVI, where it could be deleted)
- The relative weight then given to each of the two indices would reflect the time preference of users, as well as their relative concern about economic growth and environment stability.
- The relevance of integrating depends on the use of the indices for international policies



(II)

**Using vulnerability indicators for policy:
the issue of international allocation of resources**

- The previous two indicators, can be used for guiding policy, in particular the international allocation of resources, either for development assistance or for adaptation
- Such an use meets the difficult issue of the principles and criteria of international resources allocation



Geographical allocation of development assistance: the present debate

- Traditional wisdom dominated by the « PBA », the «performance based allocation »: aid should mainly be allocated to countries according to their «performance»
- PBA is first a formula used by the MDBs (and some bilateral donors) for the allocation of their concessional resources, with performance measured by the «CPIA» (Country Policy and Institutional Assessment),
- PBA is also a kind of general principle on which the international community is supposed to agree...
- But is strongly debated



(PBA formulas at IDA, AfDF, and AsDF)

- **IDA Resource Allocation Index (IRAI)**

$$A_i = \text{CPR}_i^5 \cdot \text{GNIpc}_i^{-0.125} \cdot P_i$$
$$\text{CPR}_i = 0.24 \text{CPIA}_{\text{ABC}} + 0.68 \text{CPIA}_{\text{D}} + 0.08 \text{PORT}$$

- **African Development Fund Allocation Formula**

$$A_i = \text{CPA}_i^4 \cdot \text{GNIpc}_i^{-0.125} \cdot P_i$$
$$\text{CPA}_i = 0.26 \text{CPIA}_{\text{ABC}} + 0.58 \text{CPIA}_{\text{D}} + 0.2 \text{PPA}$$

- **Asian Development Fund: Country Allocation Share (CAS)**

$$A_i = \text{CCPR}_i^2 \cdot \text{GNIpc}_i^{-0.25} \cdot P_i^{0.6}$$
$$\text{CCPR}_i = \text{PIR}^{1.4} \cdot \text{GR}^{2.0} \cdot \text{PR}^{0.6}$$

- **Carib. Development Bank)**

$$A_i = (\text{country needs}) \cdot (\text{country performance})$$
$$\text{Country needs} = \log P \cdot \text{GNIpc}^{-0.9} \cdot \text{VUL}^2$$
$$\text{Country performance} = (0.7 \text{PIP} + 0.3 \text{PORT})^2$$



Taking into account structural vulnerability would improve the PBA for five reasons

- Restoring the real meaning of performance
- Enhancing equity by compensating structural handicaps and avoiding double punishment
- Drawing lessons of aid effectiveness literature
- Increasing transparency by limiting exceptions
- Looking for stability, predictability and countercyclicality



Why a debate?

- PBA gives an overwhelming weight to the assessment of policy and governance of recipient countries (through the « CPIA » and mainly its governance component)
- It does not take into account their vulnerability, neither their distance to the MDGs (in particular in health and education)
- In spite of criticisms, reluctance of several main donors to change
- However move of ideas and better appreciation of the need to take vulnerability into account, illustrated by UN SG report to the ECOSOC Development Cooperation Forum in 2008 and 2010, by new initiatives of the AfDB, ...and the European Commission
- ...and a recent UN GA resolution (Dec 2012 A/C.2/67/L.51)



(Restoring the real meaning of performance)

- Everybody favours performance
- Genuine performance refers to outcomes with respect to given initial and external conditions
- CPIA is an assessment of policy rather than a real measure of performance, moreover a subjective assessment, according uniform norms, not fitting the alignment and ownership principles
- It does not take into account the initial and external conditions, in particular the structural economic vulnerability to shocks



(Enhancing equity by compensating structural handicaps)

- Aid allocation should look for equity: among countries as individuals, promoting equity means equalizing opportunities, and capabilities
- *Opportunity equalization involves compensating structural handicaps*
- Main structural handicaps of the LICs are vulnerability to exogenous shocks and low level of human capital, two obstacles reinforcing each other, and not taken into account in the PBA
- Two handicaps which, along with a low level of income pc, are the identification criteria of LDCs
- Moreover, if aid is allocated mainly according governance, populations suffering from bad governance are at the same time penalized by aid allocation: they are punished twice



(Drawing lessons of aid effectiveness literature)

- A double main lesson of literature: aid effectiveness is conditional on the features of recipient countries, but
- Although present policy is a significant *positive* factor of growth, its impact on aid effectiveness is *uncertain*
- Although vulnerability is a significant *negative* factor of growth, its impact on aid effectiveness is *positive* (Chauvet & Guillaumont 2001, 2004, 2010; Collier and Goderis, 2010)
- Then taking vulnerability into account in aid allocation is also legitimate to make it effective...



***(Increasing transparency and consistency
by making the rule general and effective
and treating fragile states in an integrated framework)***

- Present PBAs are implemented with multiple exceptions: country or caps and floors, and above all special treatment for fragile states
- These exceptions weaken the relationship between « performance » and allocation , making the allocation rules little transparent
- Treatment of FS in aid allocation should be not only transitional and curative, as it is, but also permanent and preventive, through the consideration of structural vulnerability



***(Making the allocation more stable,
more predictable and less procyclical)***

- Amplified effects of small changes of policy rating (CPIA, CPR, CPA, CCPR,...) on allocation, due the structure of the formula (high rating elasticity of allocation)
- Instability of the rating itself
- Procyclicality of CPIA with regard to exogenous shocks
- Taking into account structural handicaps would make allocation less sensitive to policy and governance rating, more stable and less procyclical



Towards an improvement

- Followingly, robust rationale for taking into account structural vulnerability, as well as a low level of human capital in aid allocation, besides an appropriate indicator of « performance » with a lower weight than presently: would meet principles of equity, effectiveness, transparency
- Can be done by using available and commonly agreed indicators, such as EVI (for structural vulnerability) and HAI (for human capital), used at UN for LDCs identification along with GNIpc,
- Donors explicitly invited to do it in December 2012 by UNGA resolution on the smooth transition of graduating LDCs (§23)
- and EC on the way...
- Always possible to *improve or adapt the index* of structural economic vulnerability, if needed



Performance vs vulnerability, also an issue with regard to climate change funding

- More and more resources will be devoted to the *adaptation* to climate change.
- The allocation of these resources meets the same issue as ODA
- Presently also ruled by performance/policy (eg GEF), with specific reference to environment policy, but without a clear rationale
- Since low-income countries are not responsible for climate change, it is *equitable* that the concessional funds for adaptation be allocated mainly according to the vulnerability to climate change
- So, need to consider *physical vulnerability to climate change*, through an indicator such as PVCCI, not dependent on policy
- Weak capacity to adapt for structural reasons should also be considered separately, and captured by GNIpc and HAI
- Capacity to implement, an effectiveness criterion, may be added



Criteria for the allocation of adaptation resources: common features with ODA

- A weak *capacity to adapt* for reasons not depending on present policy (ie a low structural resilience), legitimating a higher allocation in both cases, should also be considered separately ,and can be captured through the low level of GNIpc and HAI
- But a low *performance rating* (policy and governance), or capacity to implement (as named in the climate change literature), as an effectiveness criterion , may lead to a lower allocation (with a smaller weight than presently)
- It may also lead to *specific modalities* of support (projects vs budget)



Comparison of vulnerability as an allocation criterion for adaptation resources and for ODA

- Physical vulnerability criterion, more clearly exogenous and easily accepted than the structural economic vulnerability one :
can the ODA allocation be influenced by climate adaptation?
- Reference to effectiveness (« performance ») may in both cases be also needed , but not clear what kind of performance is relevant in each case, in particular for the adaptation to climate change :
 - environmental performance? a moral, but debatable argument
 - general performance: the same factors have an impact on development and of adaptation
- Differentiation more logical if performance assessment includes a judgement on projects implementation, as far as projects differ



Mixing the two allocation processes?

- Economic development and adaptation in poor countries are very close goals
- Although additionality is officially supposed, resources for the two goals are likely to be partial substitute
- If the two kinds of resources were merged, their geographical allocation would need to be treated simultaneously and the two kinds of vulnerability be measured through a synthetic index (while the allocation for mitigation would be treated differently)
- Anyway, a trade-off between development and adaptation goals, is unescapable, that will be reflected in the time horizon and the component weights of the index,
- Allocation of international resources is a policy choice , and the choice of indices as well.

FWDi

Thanks