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A RECOGNIZED INDEPENDENT CENTRE OF THE UNIVERSITY OF OXFORD



Discussion on Getting Global Agreements on Climate Issues; Problems and Prospects

British Institute of Energy Economics

Royal Society, London

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SO₂ versus CO₂

- Acid rain legislation has been successful (at least in the US). Emissions reduced at a fraction of the cost initially projected.
- Acid rain is a national externality
- Global warming legislation has not
- Global warming is international

The international dimension must, I think, be the main reason why we have failed to reduce global warming emissions

Overview

- **Motivation:** Support Climate Change actions by estimating of the respective capability to pay of nations
- **Focus:** GDP, GDP per capita and poverty (energy and climate change does not matter here)
- **Key question:** What is the fair capability to pay for each country?
- **Being as objective as possible, independent of responsibility and simple as possible**

Motivation

Capability will be a crucial component of any Climate Change solution:

- It is stipulated in Article 3.1 of UN Framework Convention on Climate Change
- Even those who seem to favour price-based instruments agree that capability to pay should matter (Nordhaus, Sachs, Kim)
- ...but no one has yet formalized this (with one exception)
- ... and existing categorizations (LDCs, HDI) not fit for purpose.

What makes a good formula?

- Fits some concept of fairness;
- is based on comparable available data;
- is uncontroversial in its parameterization;
- takes the world as it is;
- and is unit and aggregation invariant.

Our proposal

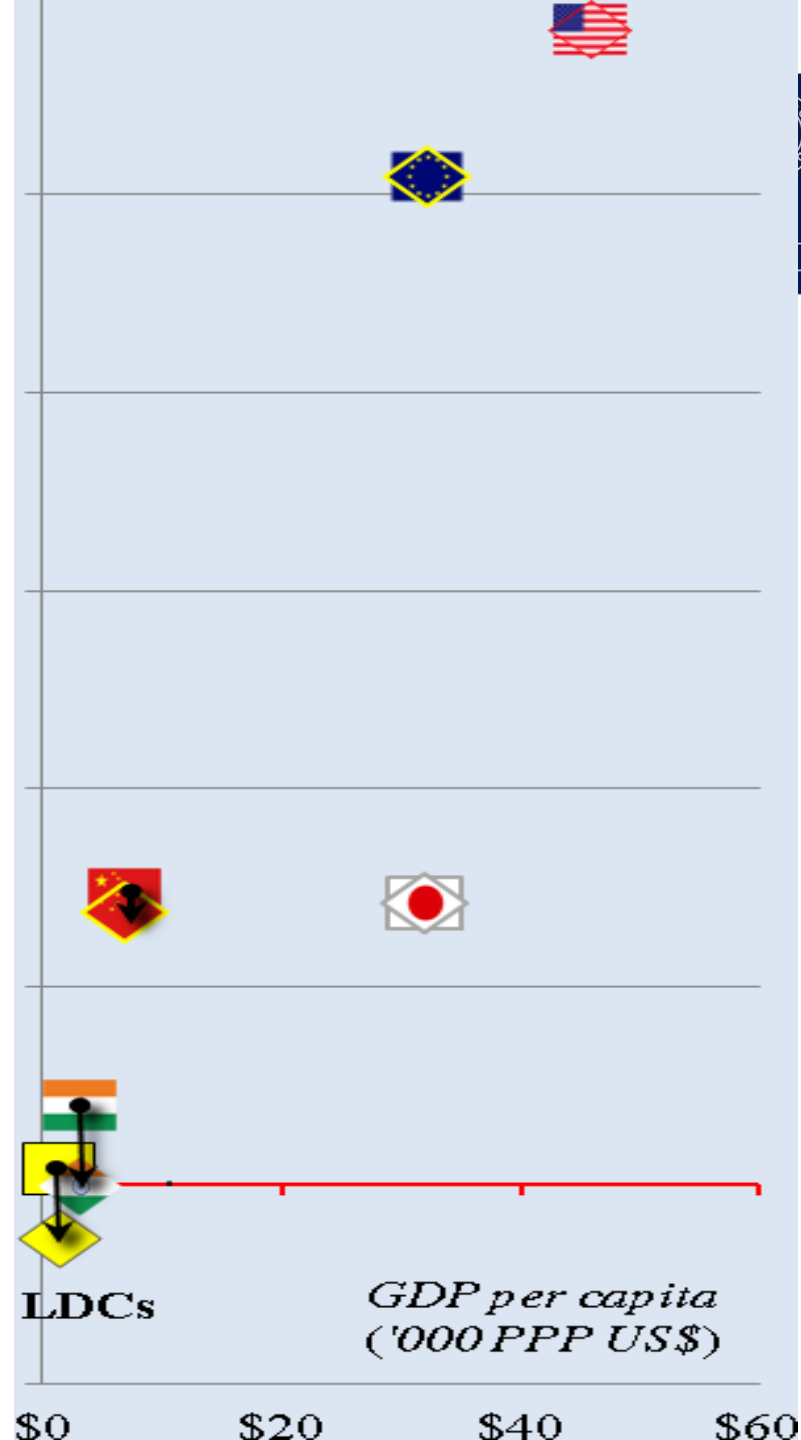
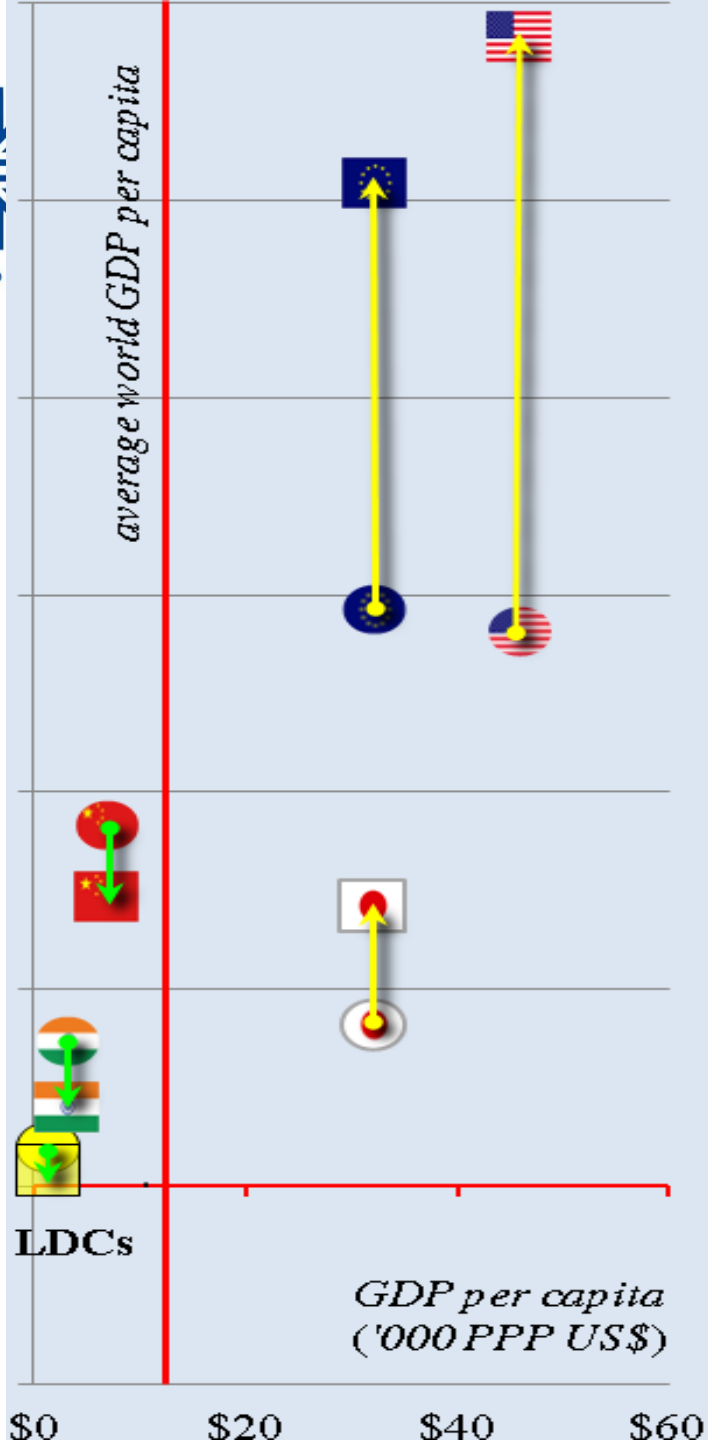
Capability should be a progressive function of **economic size**, with exemptions for **poverty**

or ... $\text{Capability} = \text{Size} * f(\text{size}) - \text{Exemptions}$

where lower case is in per capita terms

Divide both sides by population

implies... $\text{capability} = \text{size} * f(\text{size}) - \text{exemptions}$



Comparison with vulnerability

‘*impact cost intensity of GDP*’, the percentage changes in GDP due to climate impacts.

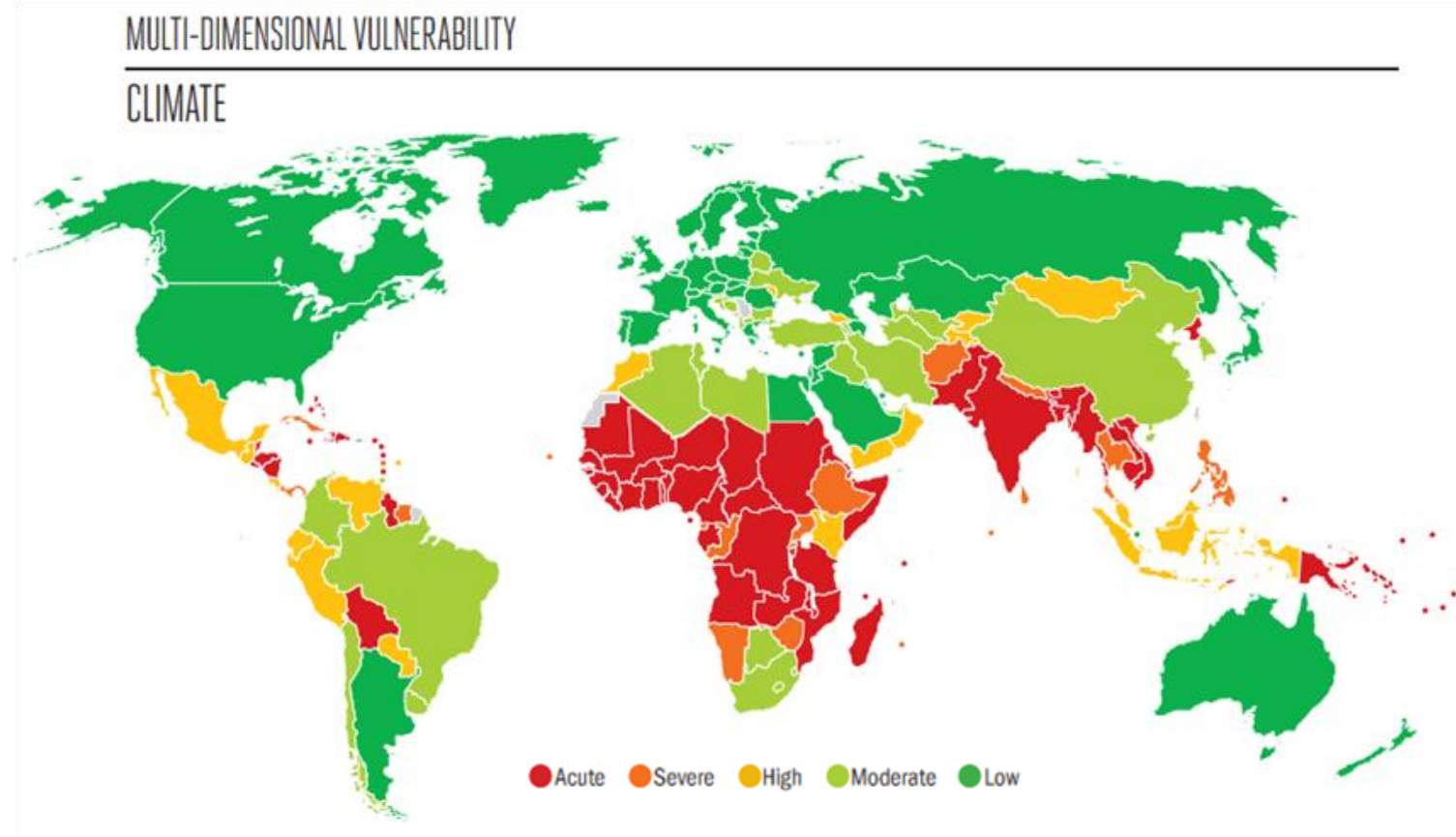
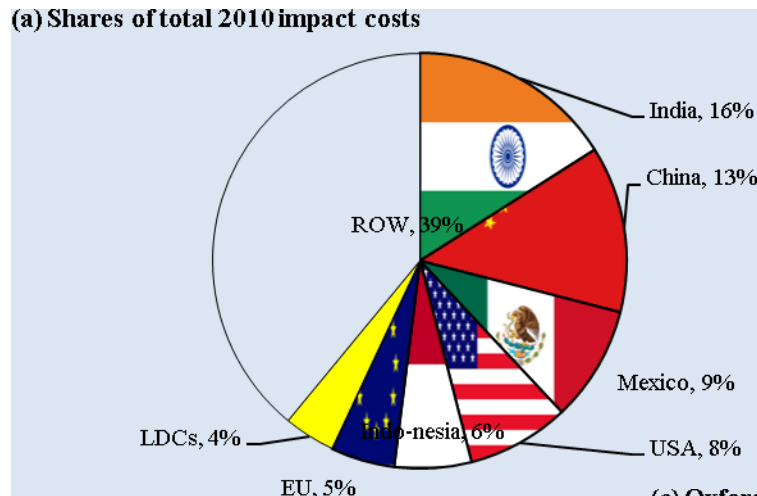


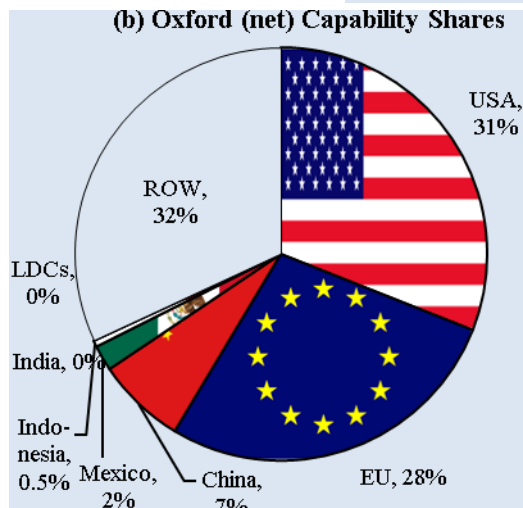
Figure IV.1.ii. Multidimensional Climate Vulnerability
 Source: CVM2:19

In terms of shares of total \$ impact

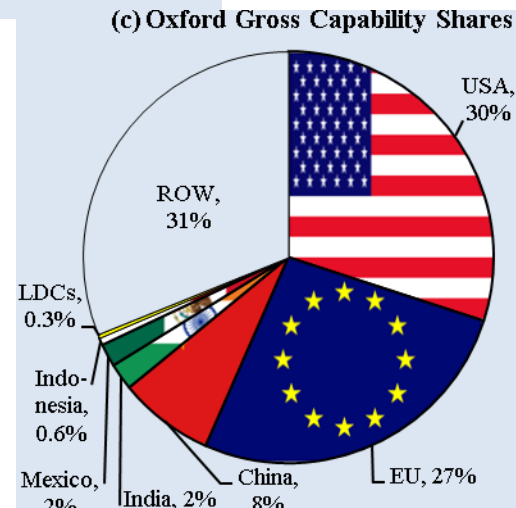
(a) Shares of total 2010 impact costs



(b) Oxford (net) Capability Shares



(c) Oxford Gross Capability Shares



Excess cost share

- $ECS = \text{Actual Cost Share} - \text{Benchmark Cost Share}$
- $ECS(+)$ = Sum of positive ECS is a measure of the *level of inequity* of the actual distribution, relative to that benchmark
- If $ECS(+)$ is zero, actual distribution is fair
- If $ECS(+)$ is one, then extremely unfair
- On the DARA data, we find a level of inequity of 63 per cent

Conclusion

- The design of any international climate finance scheme should take into account GDP, GDP per head and poverty.

Income taxation paradigm

- The idea is drawn from income tax.
- Key features
 1. Tax is a function of the current earnings
 2. Progressive (the more you earn, the higher your average tax rate)
 3. Thresholds/exemptions for other factors
 4. Income tax though not fully optimal, has been pervasive worldwide since the 18th Century
- It is seen as fair (Robespierre).



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Can we calibrate this?



Key elements to success of design

- Estimates of progressivity; $f(\text{size})$
- Size of poverty exemption

Less critical to success of the design

- Particular measure of economic size- for the moment, we assume this is GDP at PPP \$s (2009)

Progressivity

- The concept of vertical equity is the guiding principle of income tax within a country
- Those who earn more pay a higher share of taxes of their total income

Hence $\text{share} = f(\text{gdp}) = (\text{gdp} / \text{gdp_world})^{\Delta}$

If $\Delta = 0$, capability = gdp, constant tax per unit income,

if $\Delta < 0$ regressive and if $\Delta > 0$, progressive

How can we calibrate delta?

We look at the estimates of delta implicit in each countries income distribution,
The median value of 0.5, and use that.

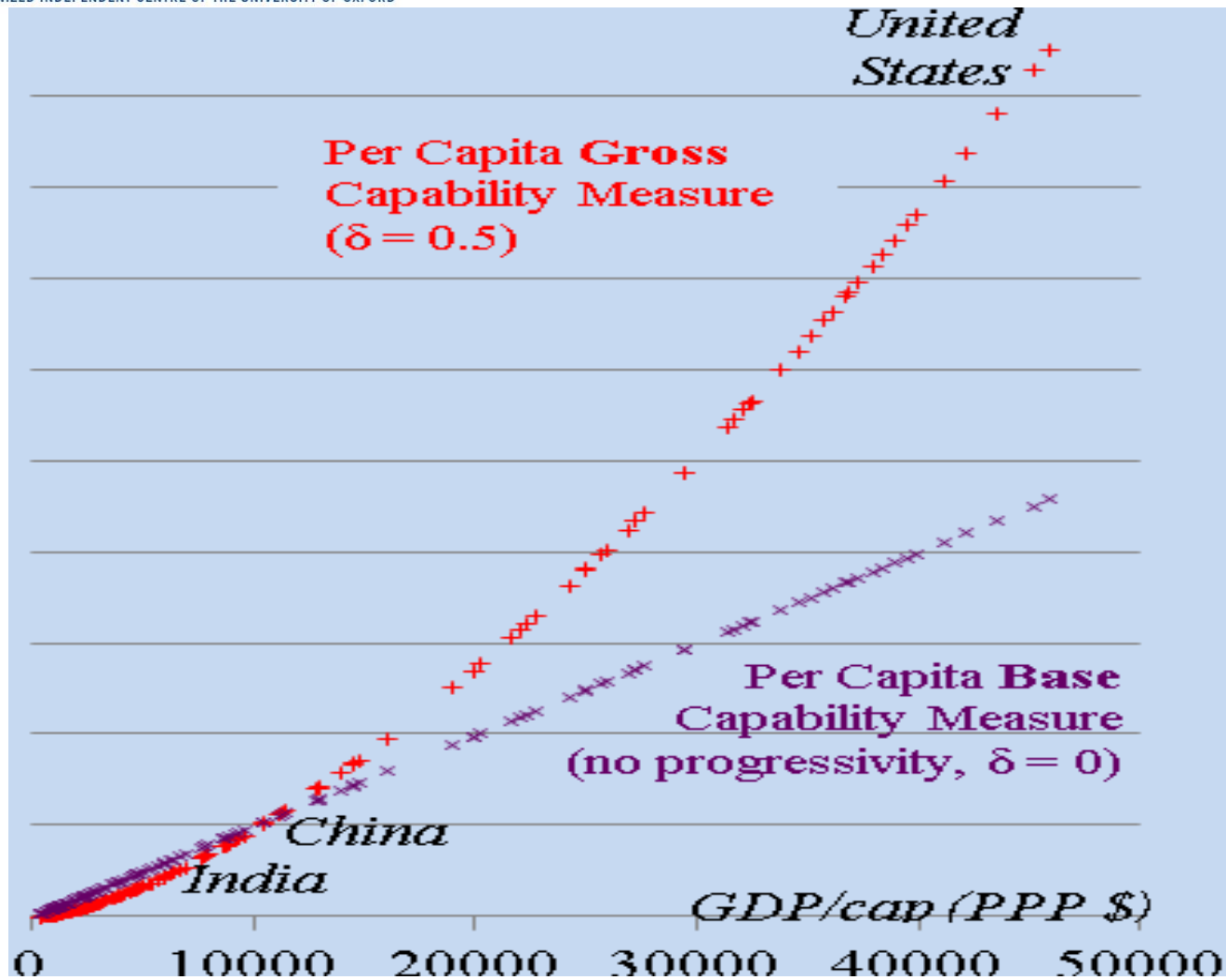


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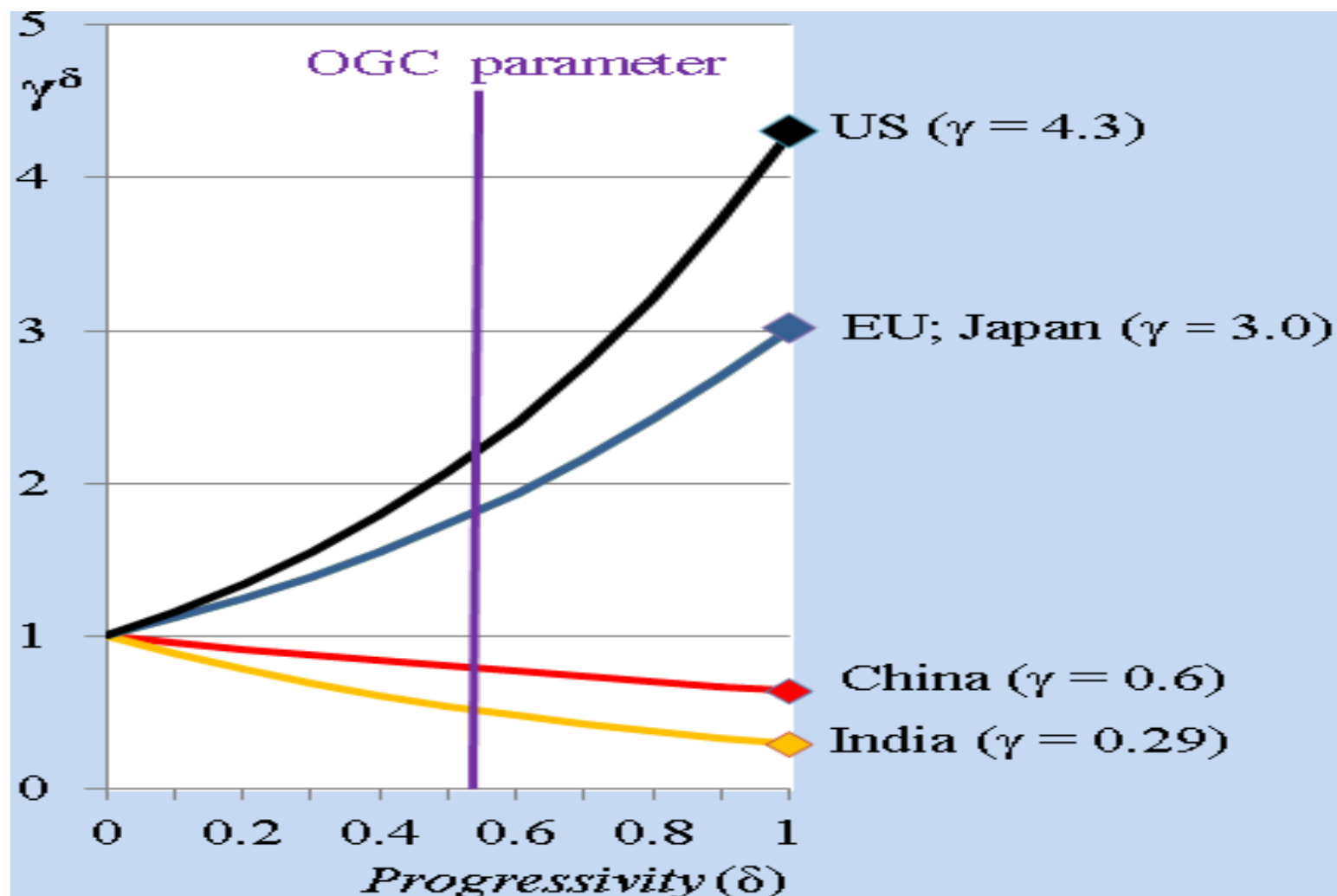


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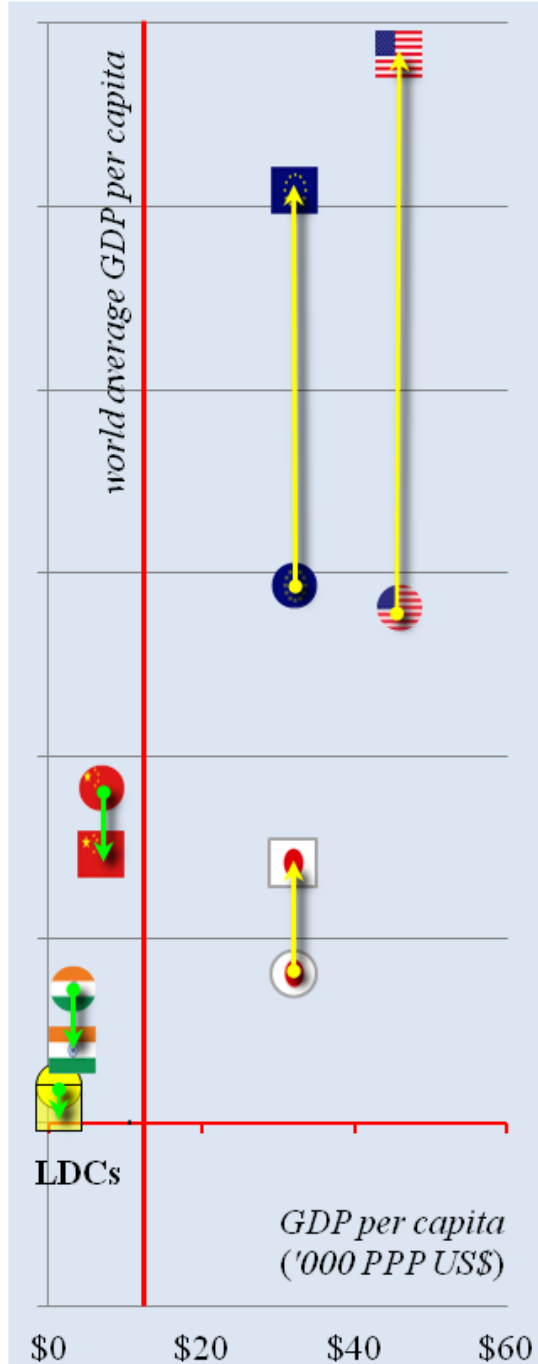


Figure II.1.5 i Base and Cross Capability:

Net Capabilities

- While many exemptions can be argued for, we think that only poverty (numbers and intensity) should matter
- This is in keeping with the principle of keeping with “taking the world as it is”- you don’t assume poverty can be alleviated easily or try to alleviate poverty with this scheme

How do we formalise this?

- As **Exemptions = P_i * No of Poor * Their Poverty Intensity**
- Where the number of poor and poverty intensity are as measured by the Oxford University International Development/UN, and takes account of many factors (not just \$2 per day)
- And where P_i is a parameter to be determined

The Tao of Pi

Capability=GDP*(gdp/gdp_world)^delta-Pi*No. Poor*Poverty intensity

For each country, Π_{dot} is the value of Π at which capability is zero

- **$\Pi_{\text{dot}} = (\text{GDP} / (\text{No. Poor} * \text{Poverty intensity})) * (\text{gdp} / \text{gdp_world})^{\text{delta}}$**

If Π is below the Π_{dot} for that country, then that country would have positive capability.

Now choose Π such that most LDCs are exempt...

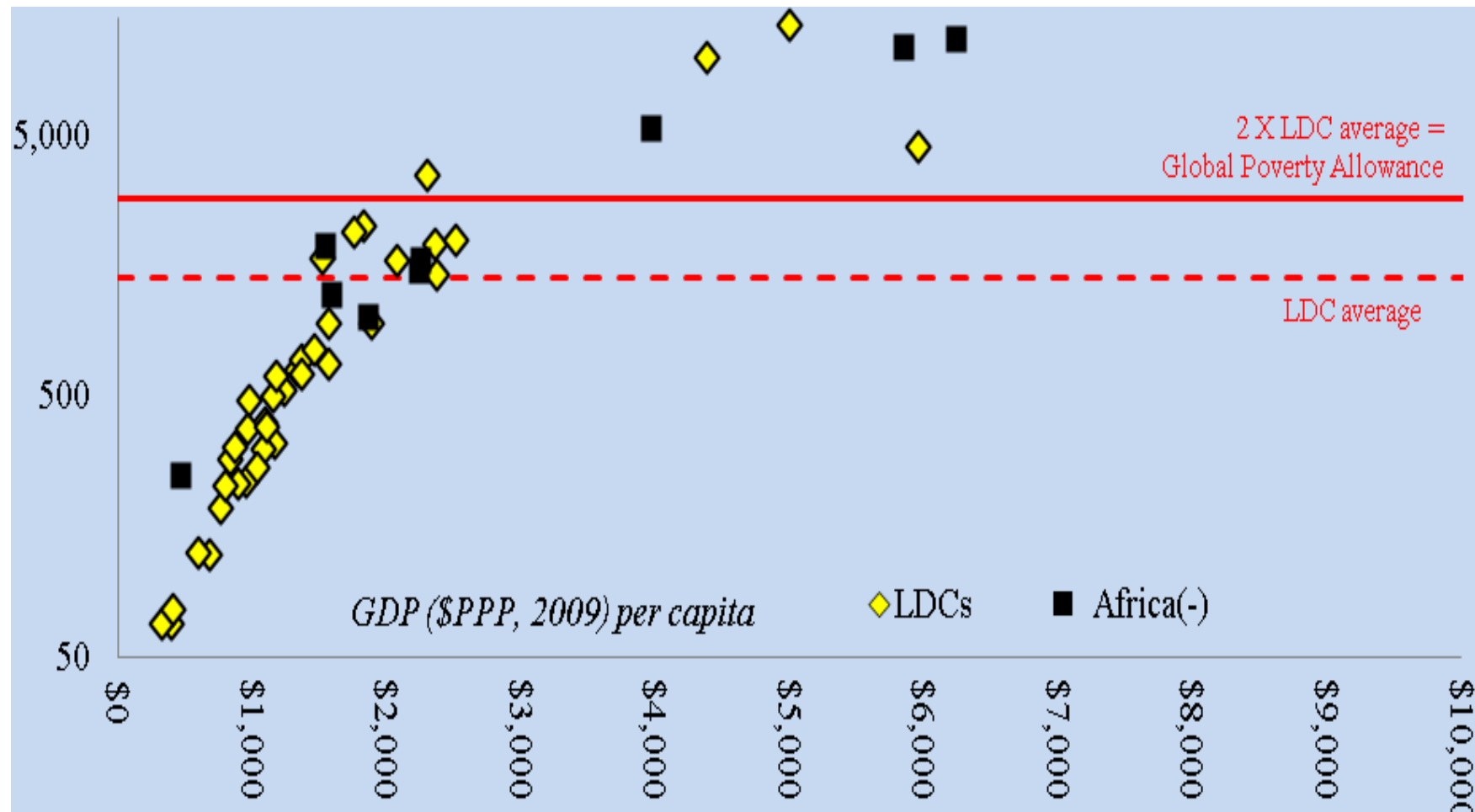


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Invariance

Capability = $GDP * (gdp / gdp_world)^{\delta} - Pi * No. \text{ Poor} * Poverty \text{ intensity}$

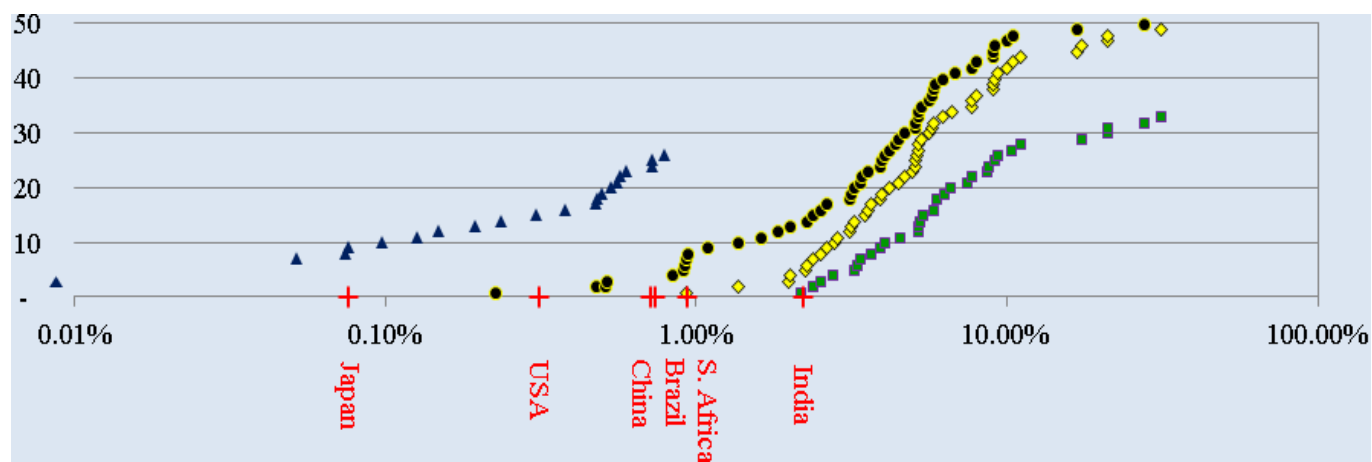
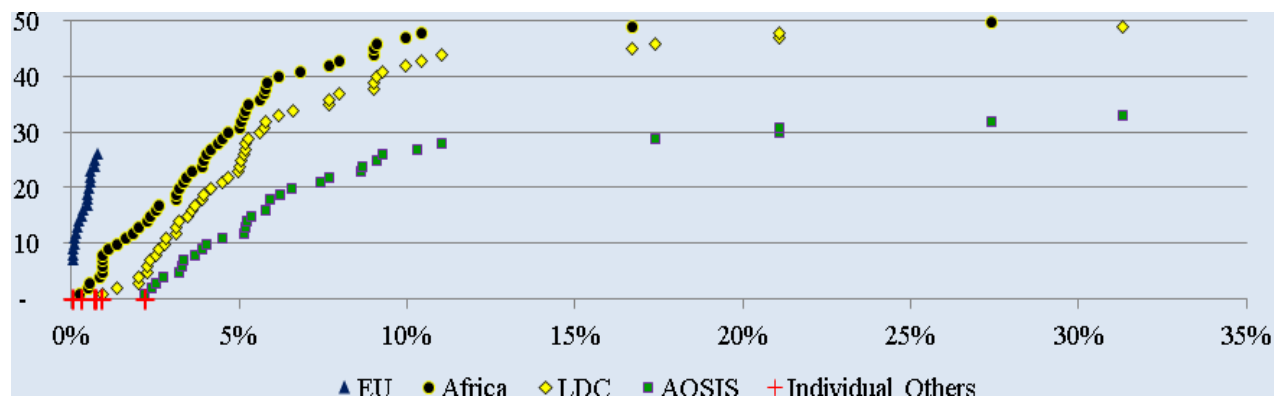
- Capability invariant to change of units (£s, \$s, shekels)- multiply Pi and GDP by the same unit
- The ratio of capabilities of any two countries independent of what happens to other countries



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In more detail

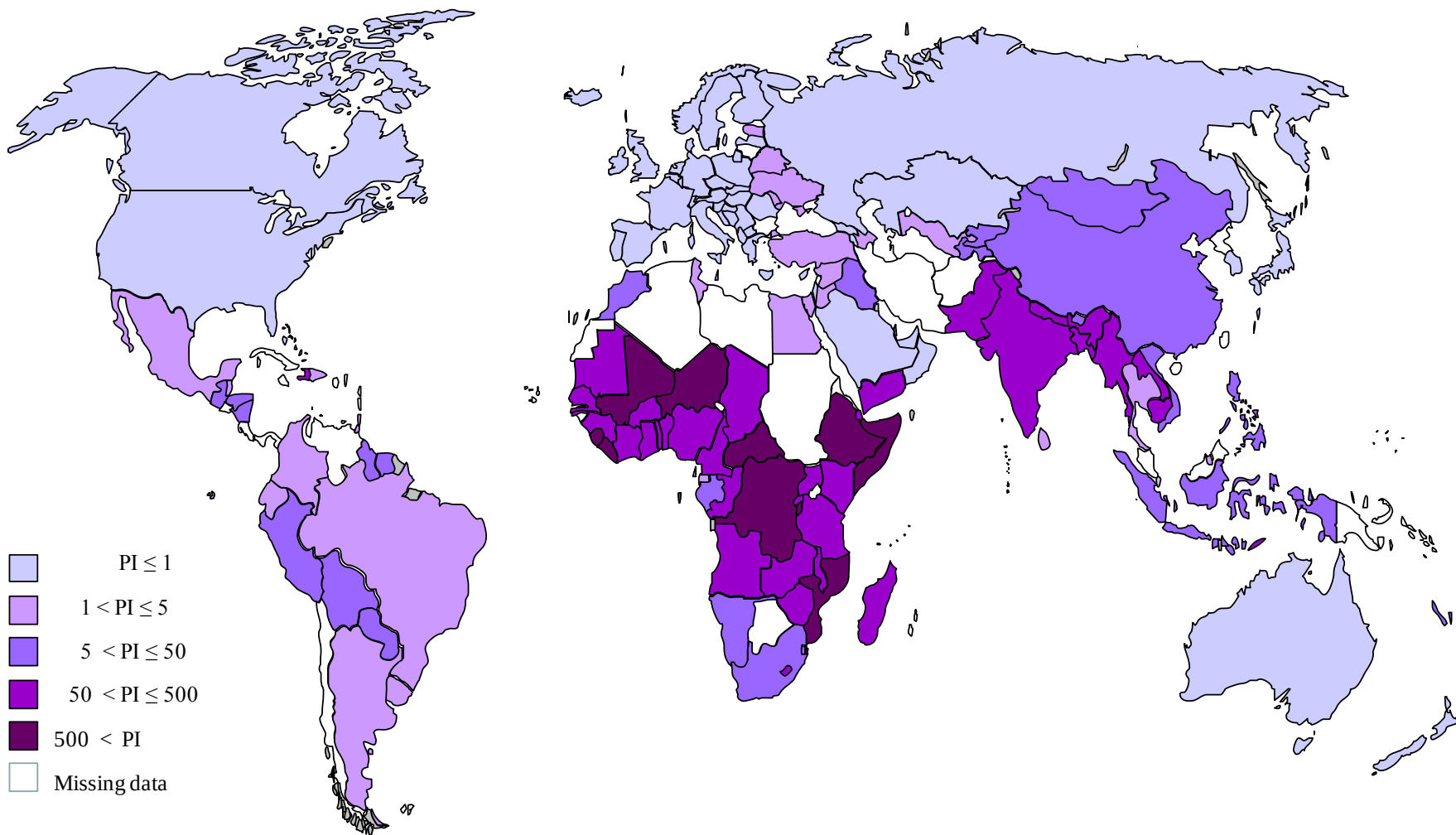




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Poverty intensity of GDP





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Spare slides

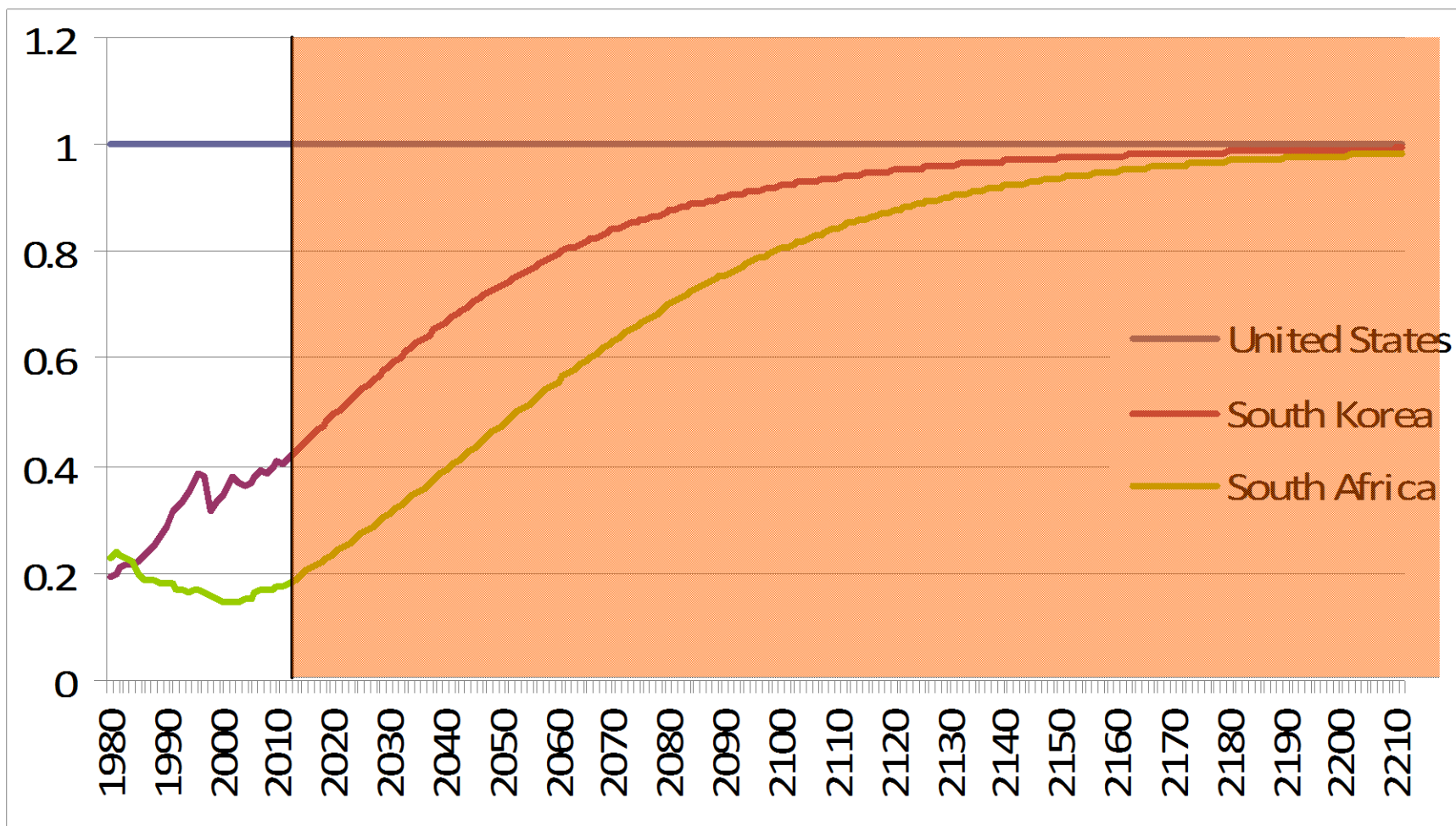


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Analysis of the choice of base ... though not crucial to our design

Name	Advantages	Disadvantages
GDP (PPP \$s)	Easy to measure	
National Wealth	The broadest measure of lifetime resources	Very difficult to measure Controversial parameters Not pay as you go
Consumption	Closest to utilitarian Equal sacrifice & progressive Hobbes vs idleness Matches PPP deflator	Can be difficult to measure (durables, housing services)
GNI	Easy to measure Adjusts for non-residency	Is non-residency always relevant?
NDP/NNI	Takes account of capital consumption	Difficult to measure Controversy over scope
GDP (current \$)	Easy to measure	Only relevant if opportunity cost is in \$s

Relative consumption per head





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Comparison with GDR



- BENITO

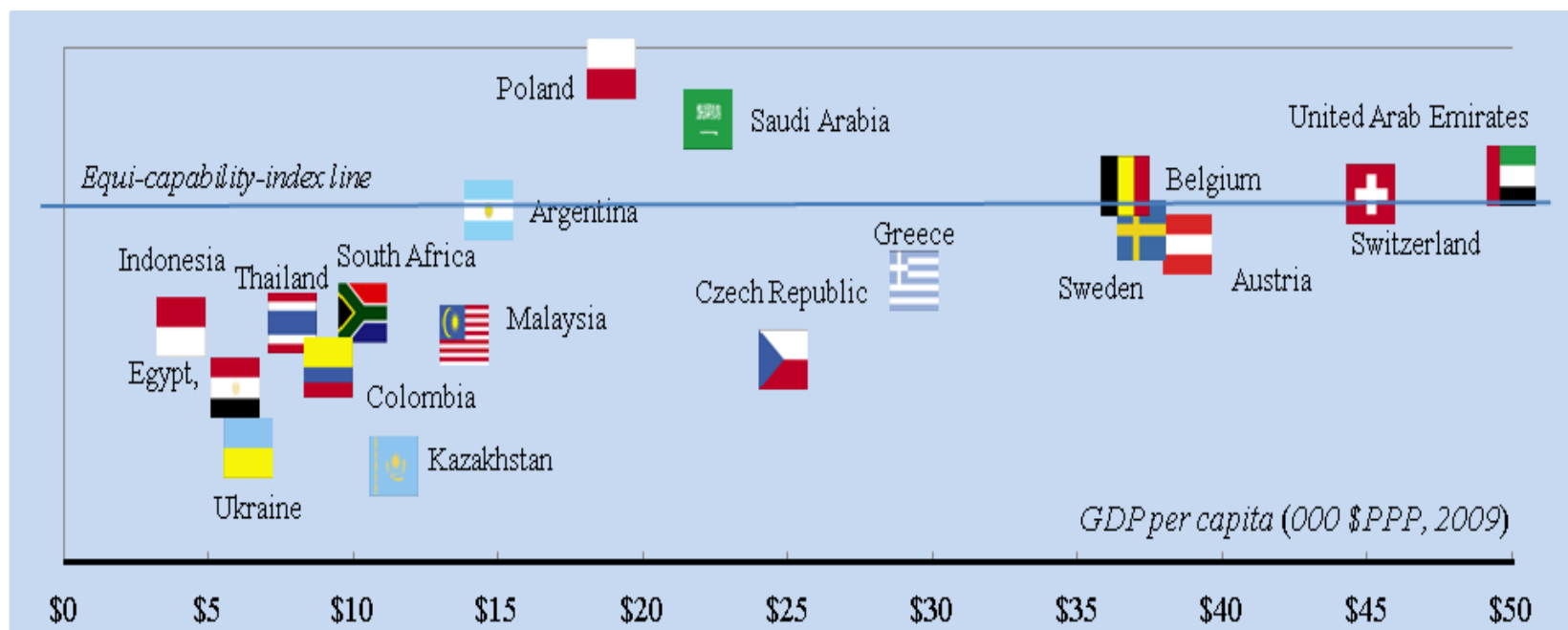


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Low capability countries



Developmental Headroom

- The gap between Π and Π_{dot} - closed by growth

