Operationalizing Equity: Ensuring High & Sustainable Human Development for All

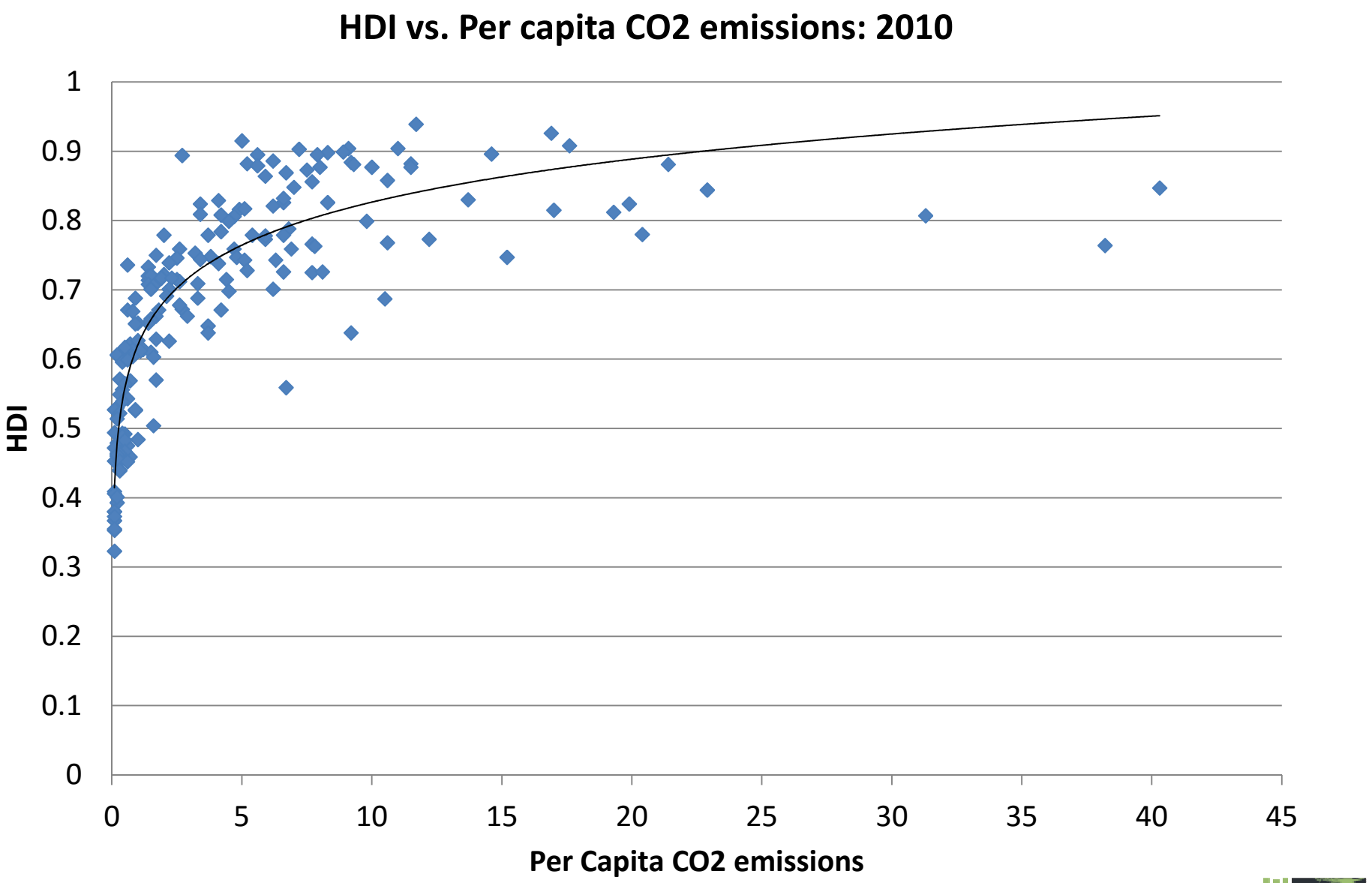
Centre for Science and Environment

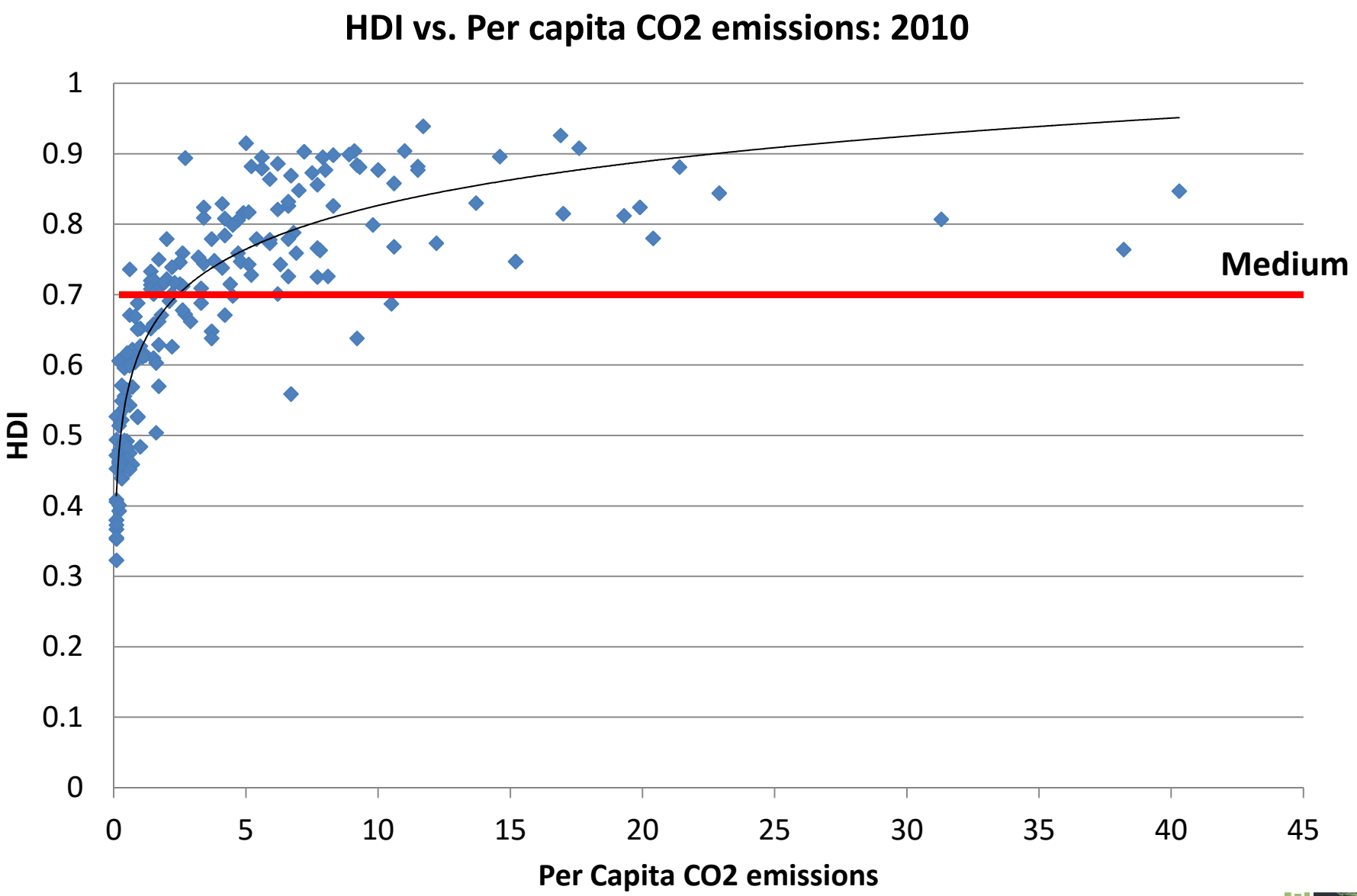
Need: *Finite Carbon budget*

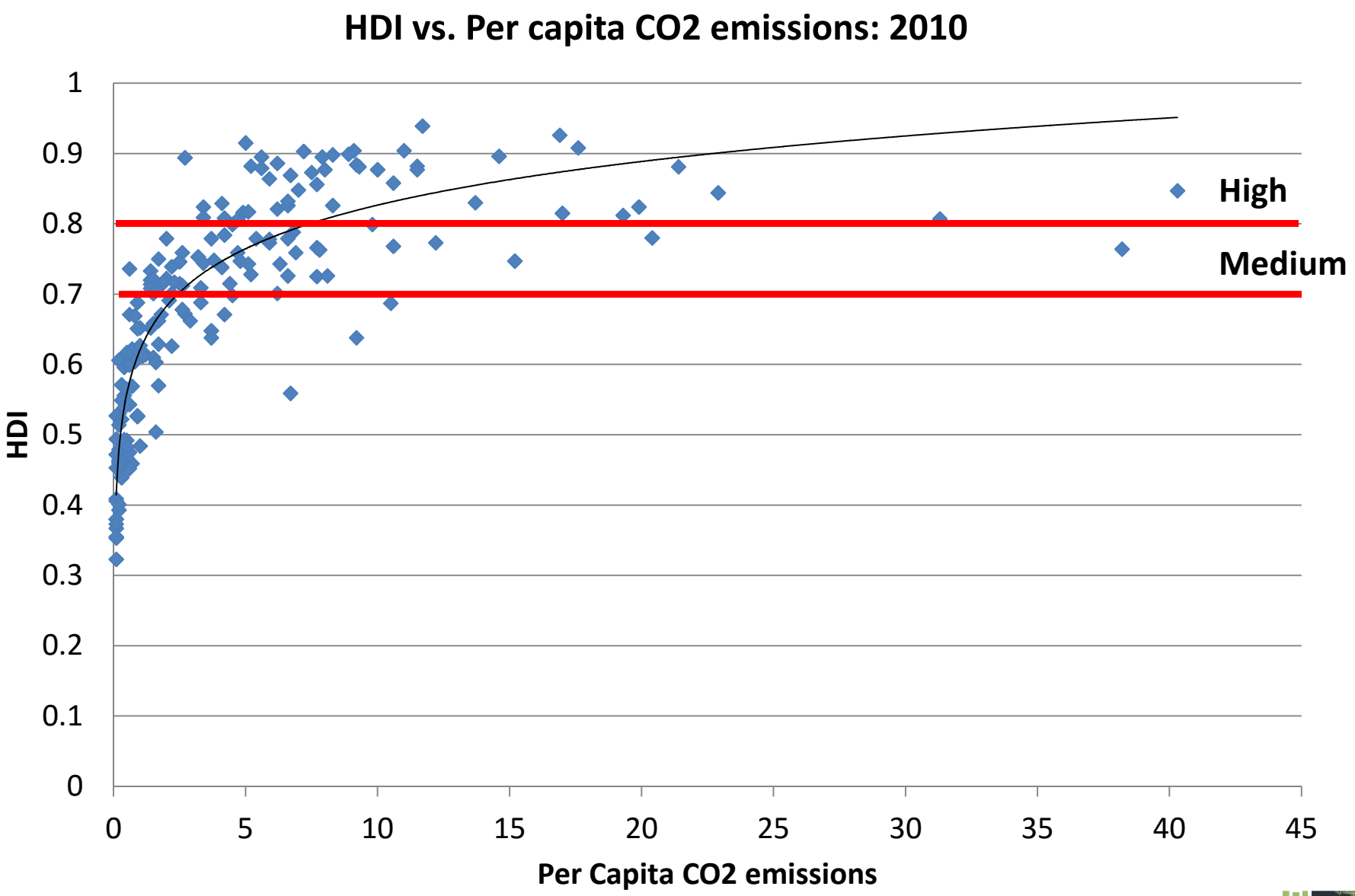
Unit: Gt CO_2e	Probability of staying within 2°C		
	>33%	>50%	>66%
Total anthropogenic CO_2 budget: 1861-1880 to 2100	5762	4441	3670
Estimated Non-CO_2 forcing: 1861-1880 to 2100	2459	1432	771
Total anthropogenic CO_2 budget remaining after excluding Non-CO_2 forcing: 1861-1880 to 2100	3303	3009	2899
Total anthropogenic CO_2 emitted: 1861-1880 to 2011	1890	1890	1890
Total anthropogenic CO_2 budget remaining: 2012 - 2100	1413	1119	1009

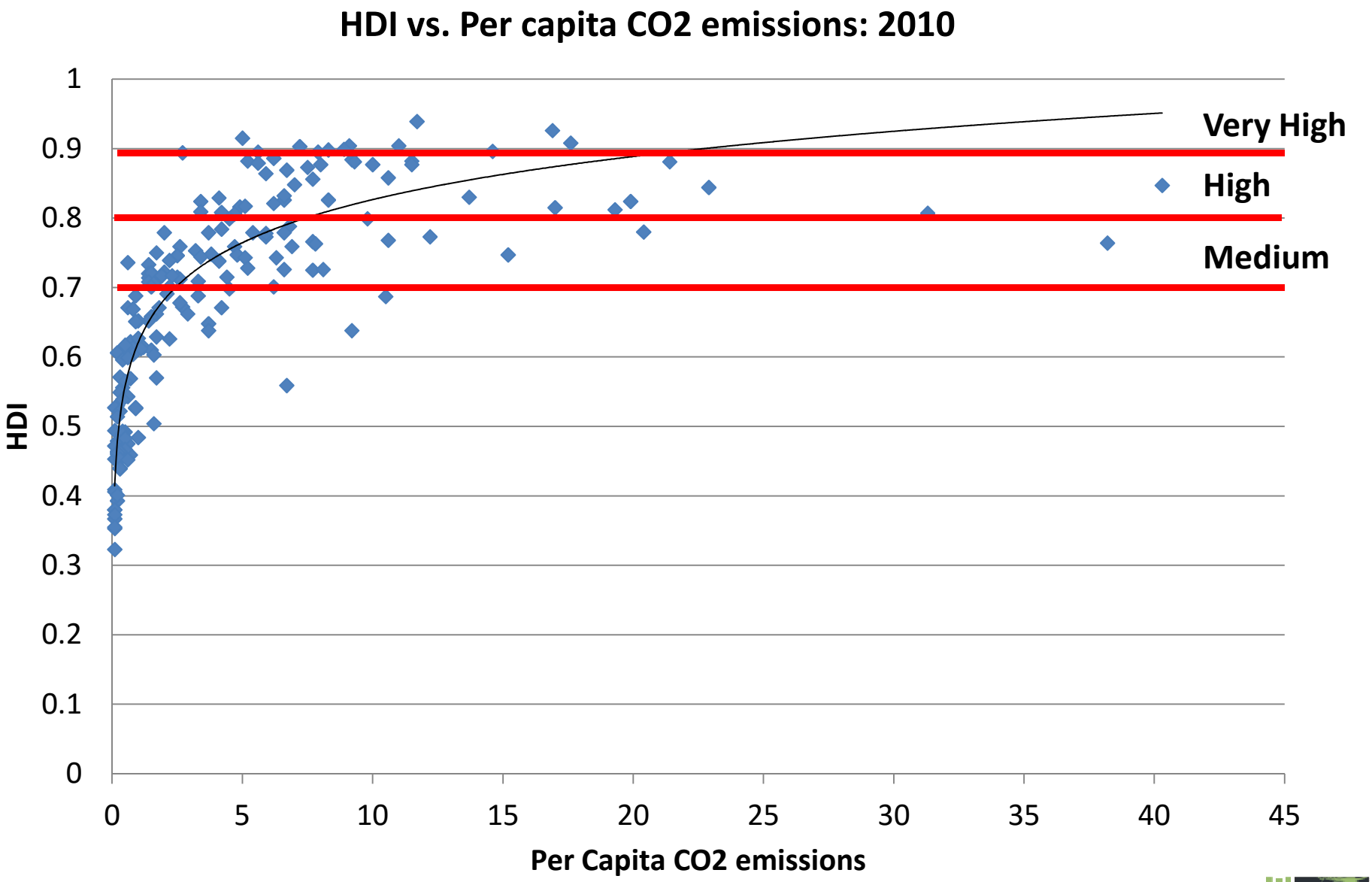
Approach: *Right to Development*

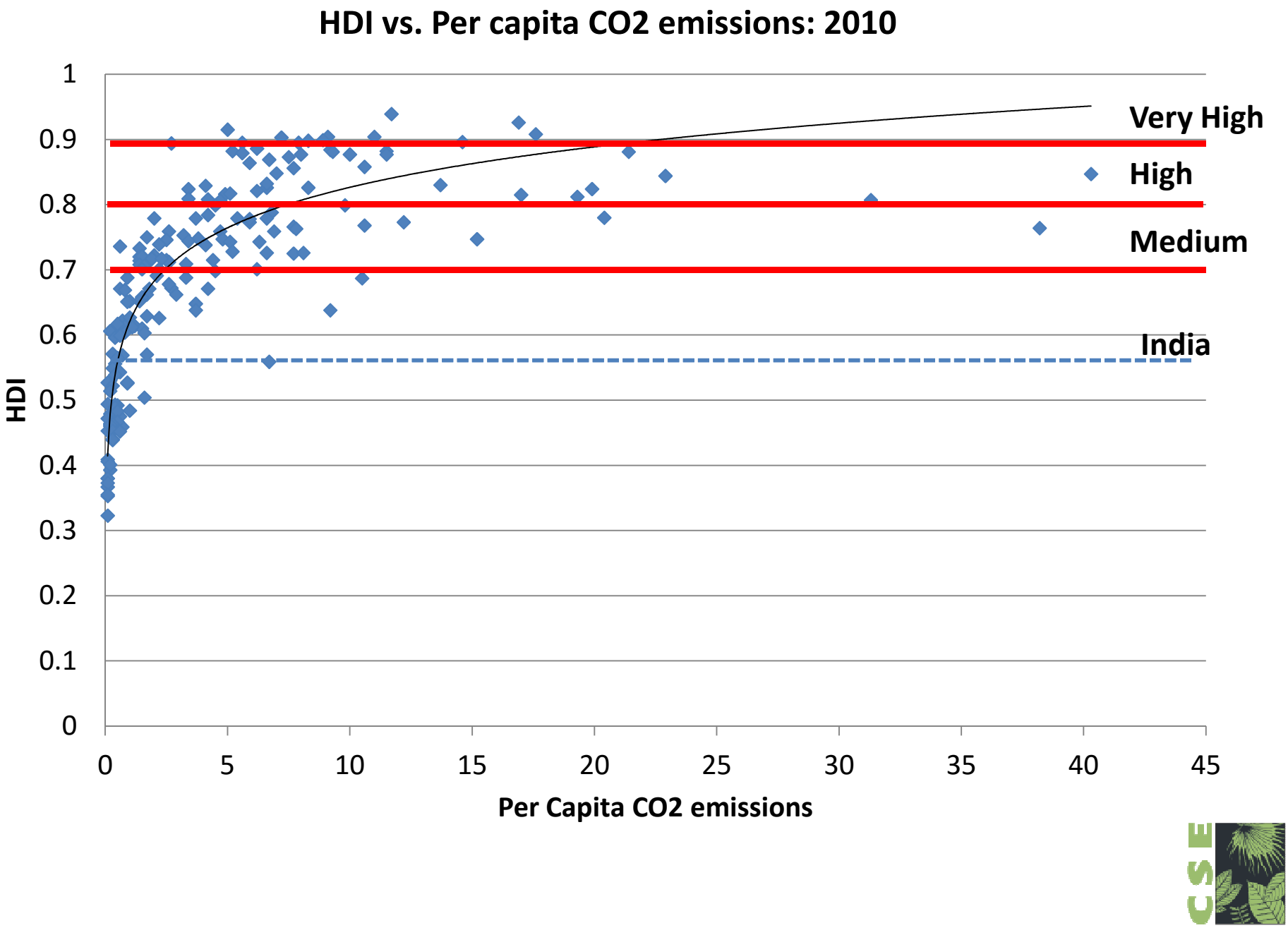
- Any climate deal must ensure that every nation has the required carbon space to meet “high” level of human development -- long and healthy life, adequate level of education to fulfill ones potential and sufficient income to meet all the basic necessities of life.
- We define human development in terms of HDI.
- We estimate the amount of carbon budget required by developing countries to meet “high” levels of HDI.
- This carbon budget is right of each developing country. They decide how to use it – sell, use till 2100, till 2050,
- **Operationalise equity through the lens of Human Development Needs**


HDI vs. Per capita CO2 emissions: 2010
HDI
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
5
10
15
20
25
30
35
40
45
Per Capita CO2 emissions


HDI vs. Per capita CO2 emissions: 2010
HDI
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
5
10
15
20
25
30
35
40
45
Per Capita CO2 emissions
Medium


HDI vs. Per capita CO2 emissions: 2010
HDI
Per Capita CO2 emissions
High
Medium
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
5
10
15
20
25
30
35
40
45


HDI vs. Per capita CO2 emissions: 2010
HDI
Per Capita CO2 emissions
Very High
High
Medium
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
5
10
15
20
25
30
35
40
45


HDI vs. Per capita CO2 emissions: 2010
HDI
Per Capita CO2 emissions
Very High
High
Medium
India
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
5
10
15
20
25
30
35
40
45

Approach: Equal Right to Development

What HDI of 0.7 – 0.9 means?

WHAT HDI OF 0.6 – 0.9 MEANS?

HDI Range of 0.9- 0.95

- Countries falling within the range of 0.9-0.95 HDI value include Norway with HDI of 0.944, Australia (0.933), Switzerland (0.917), Netherlands (0.915), United States (0.914), Germany (0.911) New Zealand (0.91) Canada (0.902) Singapore (0.901) Denmark (0.9)
- Such countries have:
  - Average life expectancy = 80 years
  - Average Expected Years of Schooling = 17
  - Average Yearly Gross national income (GNI) per capita (2011 PPP $), 2013 = $45,000

HDI Range of 0.8-0.85

- Includes countries such as Greece (0.853), Qatar (0.851) Cyprus (0.845), Saudi Arabia (0.836) Poland (0.834), Bahrain (0.815) Cuba (0.815) Kuwait (0.814) Croatia (0.812), Argentina (0.808) etc.
- These Countries have on an average:
  - Average life expectancy = 75 years
  - Average Expected years of schooling (2012) = 15 years
  - Average Yearly Gross national income (GNI) per capita (2011 PPP $), 2013 = $35,000

HDI Range of 0.7-0.75

- Countries including Sri Lanka (0.75), Iran (0.749), Brazil (0.744), Peru (0.737), Ukraine (0.734), Thailand (0.722), China (0.719), Algeria (0.717) Albania (0.716), Colombia (0.711), Dominican Republic (0.7) etc
- These Countries have:
  - Average Life Expectancy= 70 years
  - Average Expected years of schooling= 13 years
  - Average Gross national income (GNI) per capita (2011 PPP $), 2013 =$10,000

HDI Range of 0.6-0.65

- Includes countries such as South Africa (0.658), Iraq (0.642), Viet Nam (0.638), Cape Verde (0.636), Kyrgyzstan (0.628), Namibia (0.624), Morocco (0.617), Nicaragua (0.614), Tajikistan (0.607)
- These Countries have on an average:
  - Average Life Expectancy= 70 years
  - Average Expected years of schooling = 11 years
  - Average Yearly Gross national income(GNI) per capita (2011 PPP $), 2013 = $ 6000

Approach: *Equal Right to Development, but within remaining budget*

IPCC AR5

- Carbon Budget, 2012-2100: 1413 GT CO2
- Global GHG emissions in 2050, 40-70% below 2010 levels and emissions levels near zero or below in 2100.

UNEP Emissions Gap Report 2014

- To stay within the 2 °C limit, global carbon neutrality will need to be achieved sometime between 2055 and 2070.
- To stay within the 2 °C limit, total global greenhouse gas emissions need to shrink to net zero some time between 2080 and 2100.

First right over remaining carbon space…

- What is the carbon space required for developing countries to achieve High (0.8) and above HDI by 2050 and reach net zero CO2 emissions by 2070.
- The world remains within the available carbon budget (1413 GT CO2 from 2012-2100)
- Developed countries get what is left, as they have exhausted their budget. If they need more, they can trade with developing countries.

Multiple scenarios

- Our approaches for forecasting future per capita emissions essentially follow three broad scenarios:
  - Natural progression of HDI and a global regression of per capita CO_2 vs HDI
  - Forced progression of HDI and a global regression of per capita CO_2 vs HDI
  - Business as usual scenario, through individual country-by-country regression of per capita CO_2 vs HDI

Progression of HDI

- “Forced" progression of HDI is used to determine the carbon budget required for every country to reach 0.9 HDI (and 0.8 HDI)
- Irrespective of whether a country reaches 0.9 HDI or not by 2050, it has every right to be entitled to that carbon space
- As illustrated in following table, countries with different values of HDI such as 0.300, 0.350, 0.400 and so forth are ultimately “forced” to reach 0.900 in 2050

Forced progression of HDI (0.9 HDI)

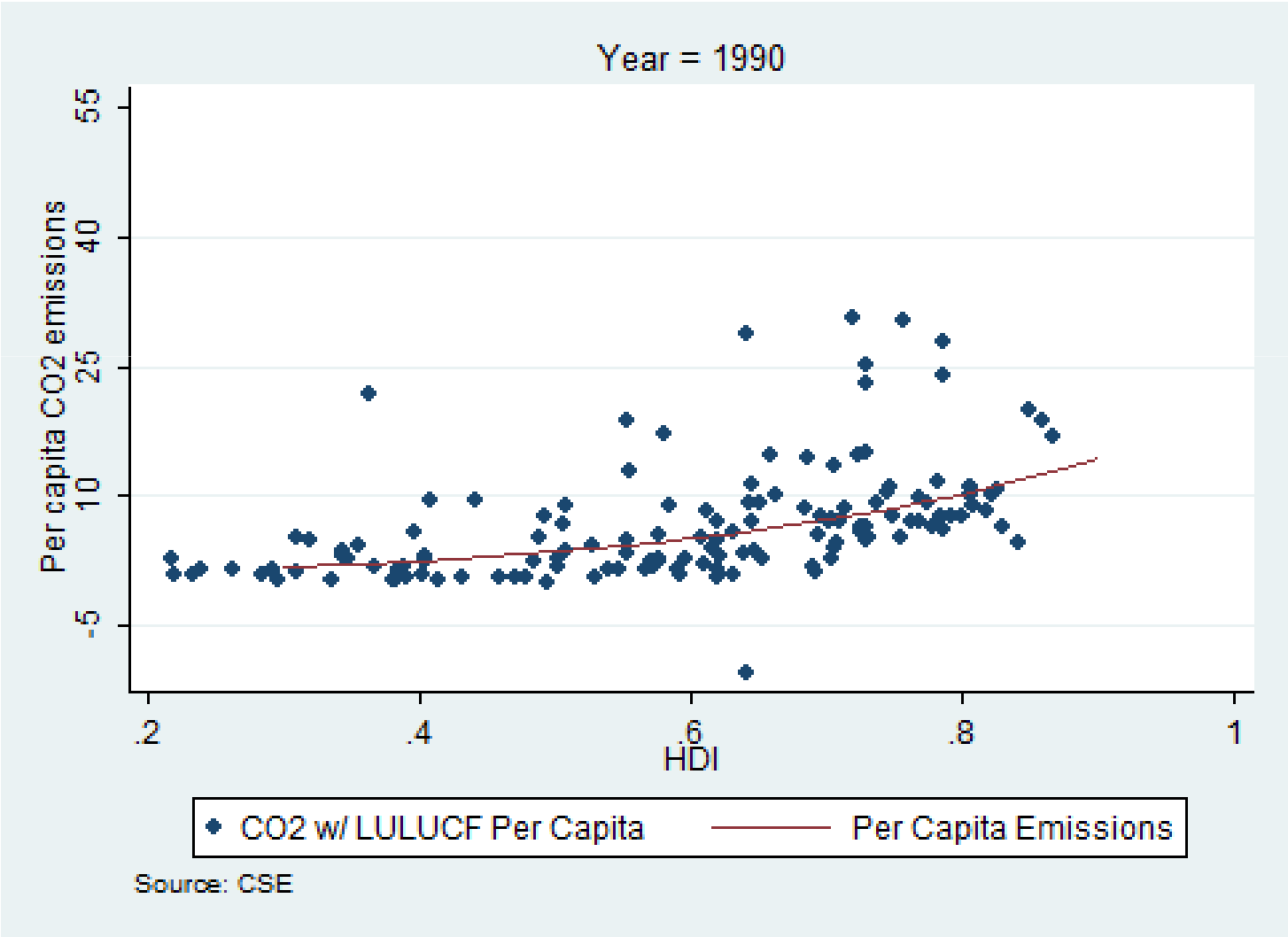
2012	2015	2020	2025	2030	2035	2040	2045	2050
0.300	0.350	0.425	0.500	0.575	0.650	0.750	0.825	0.900
0.350	0.400	0.475	0.550	0.600	0.675	0.750	0.825	0.900
0.400	0.450	0.500	0.575	0.625	0.700	0.775	0.825	0.900
0.450	0.500	0.550	0.600	0.675	0.725	0.775	0.850	0.900
0.500	0.525	0.575	0.650	0.700	0.750	0.800	0.850	0.900
0.550	0.575	0.625	0.675	0.725	0.750	0.800	0.850	0.900
0.600	0.625	0.675	0.700	0.750	0.775	0.825	0.850	0.900
0.650	0.675	0.700	0.725	0.775	0.800	0.825	0.875	0.900
0.700	0.725	0.750	0.775	0.800	0.825	0.850	0.875	0.900
0.750	0.750	0.775	0.800	0.825	0.850	0.875	0.900	0.900
0.800	0.800	0.825	0.825	0.850	0.875	0.900	0.900	0.900
0.850	0.850	0.850	0.875	0.875	0.900	0.900	0.900	0.900
0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900

Similar “forced” scenarios were also done with countries reaching a maximum of 0.85 HDI as well as 0.8 HDI

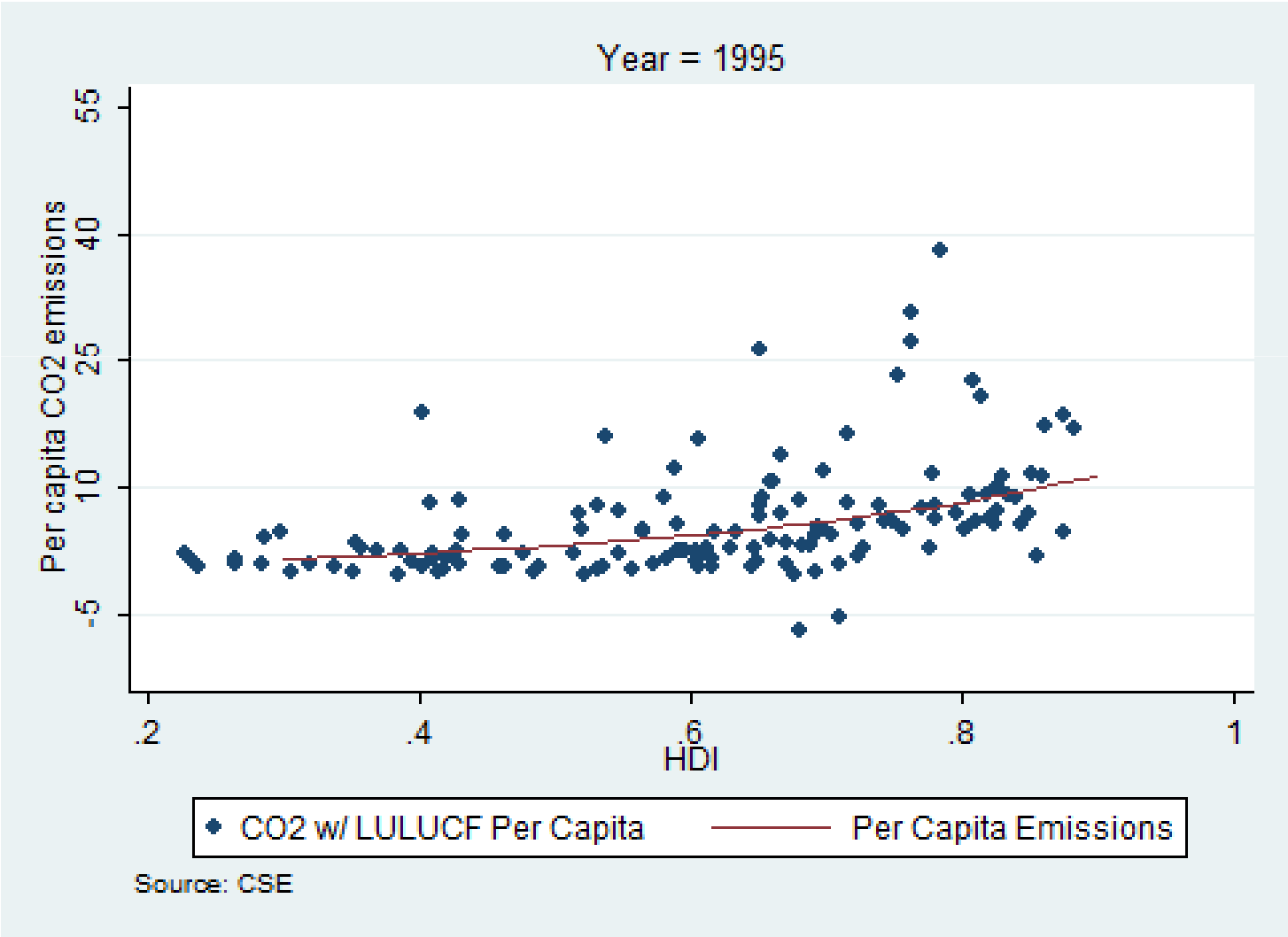
Estimating Per Capita CO_2 Emissions for given HDI level

- Estimation of future per capita CO_2 emissions has a two steps process
  - estimate the nonlinear relationship between per capita CO2 (weighted by population) and HDI across all countries for each year from 1990 through 2012, and estimate per capita CO2 emissions for various hypothetical values of HDI
  - determine the nonlinear time trend for estimated per capita CO2 emissions over years at different level of HDI values, and predict per capita CO2 emissions for the future years
- The non-linear relationships in both the above cases were found to be exponential as shown in following graphs

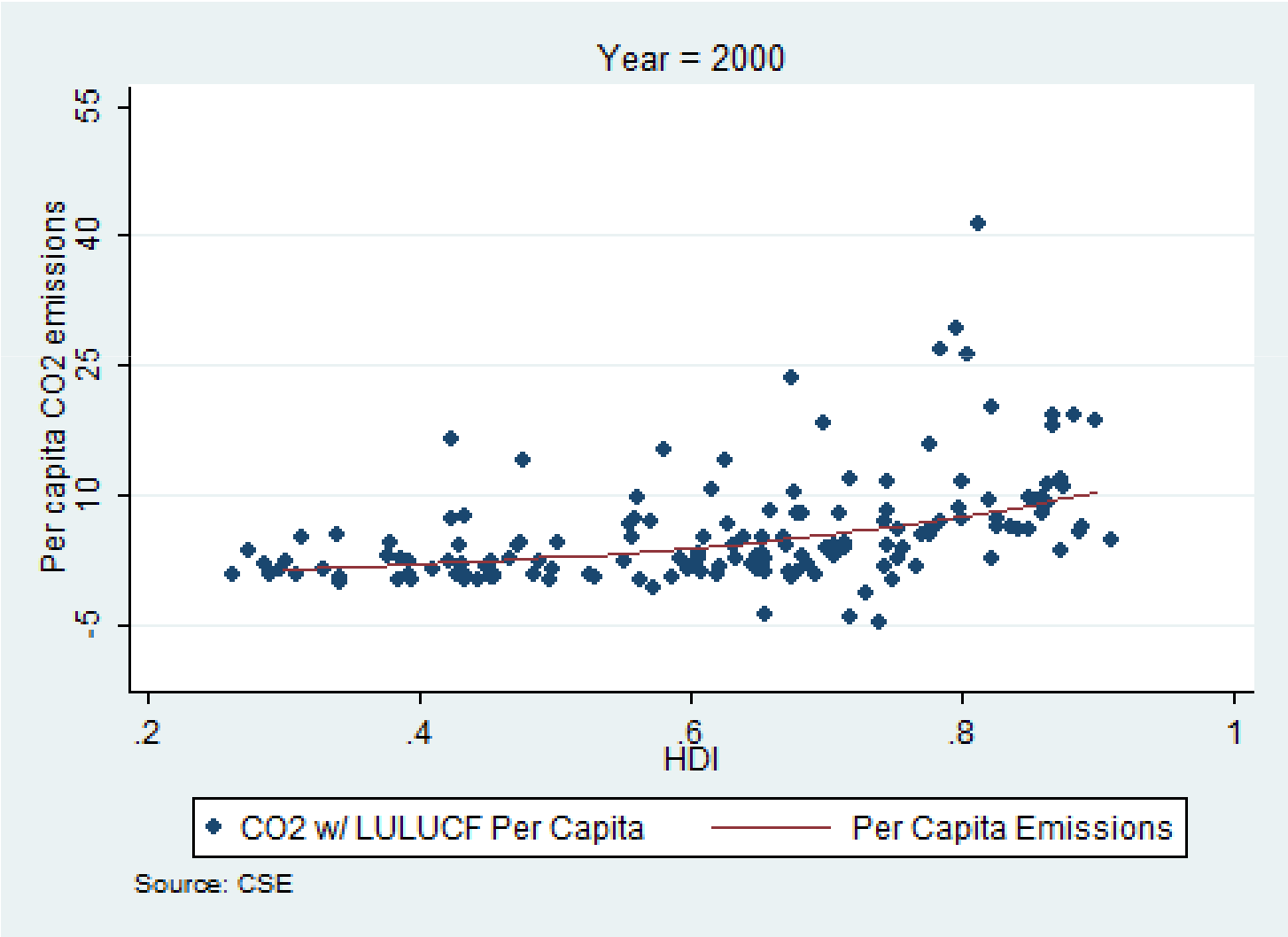
Per capita emissions v/s HDI – 1990



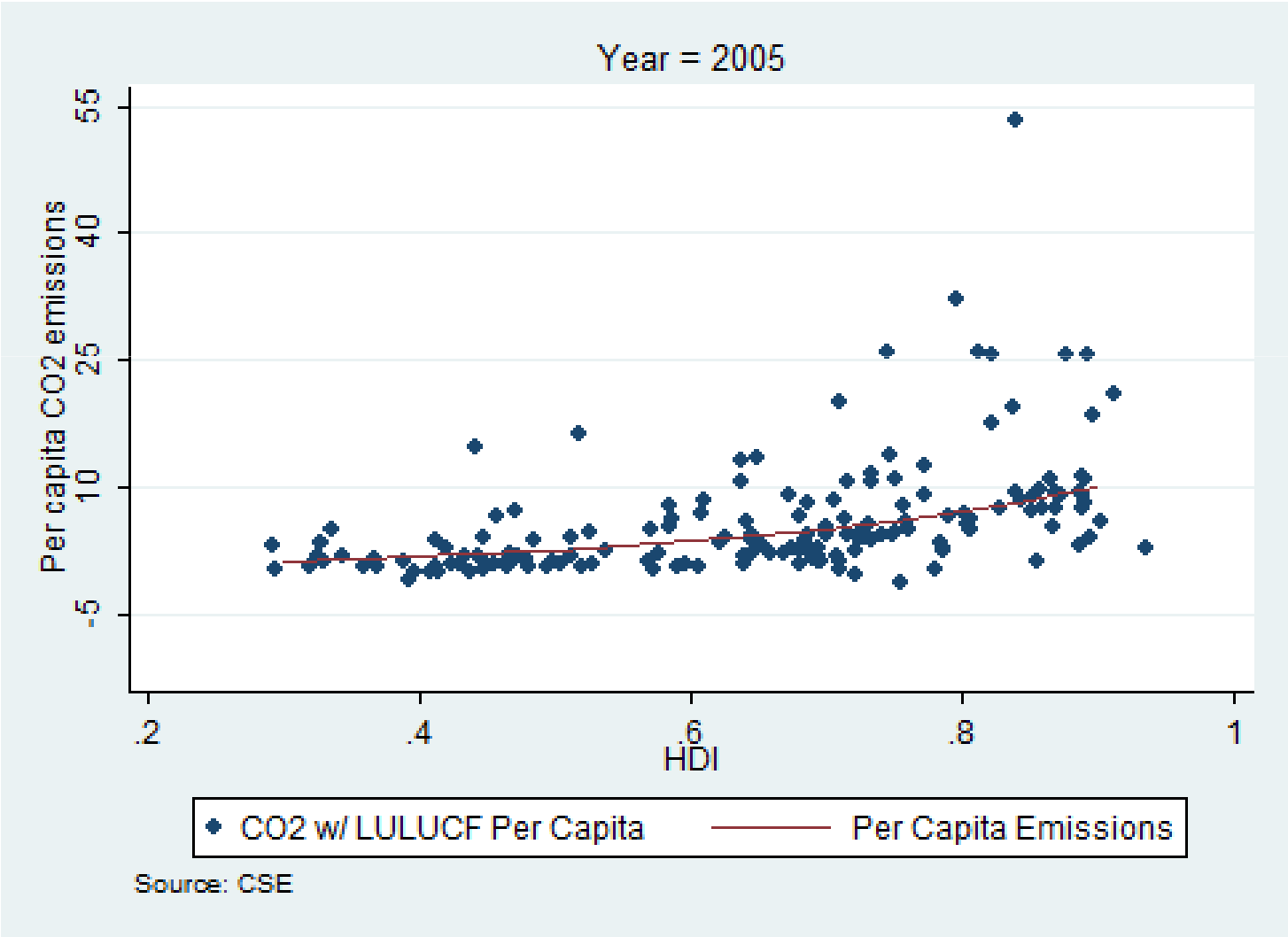
Per capita emissions v/s HDI – 1995



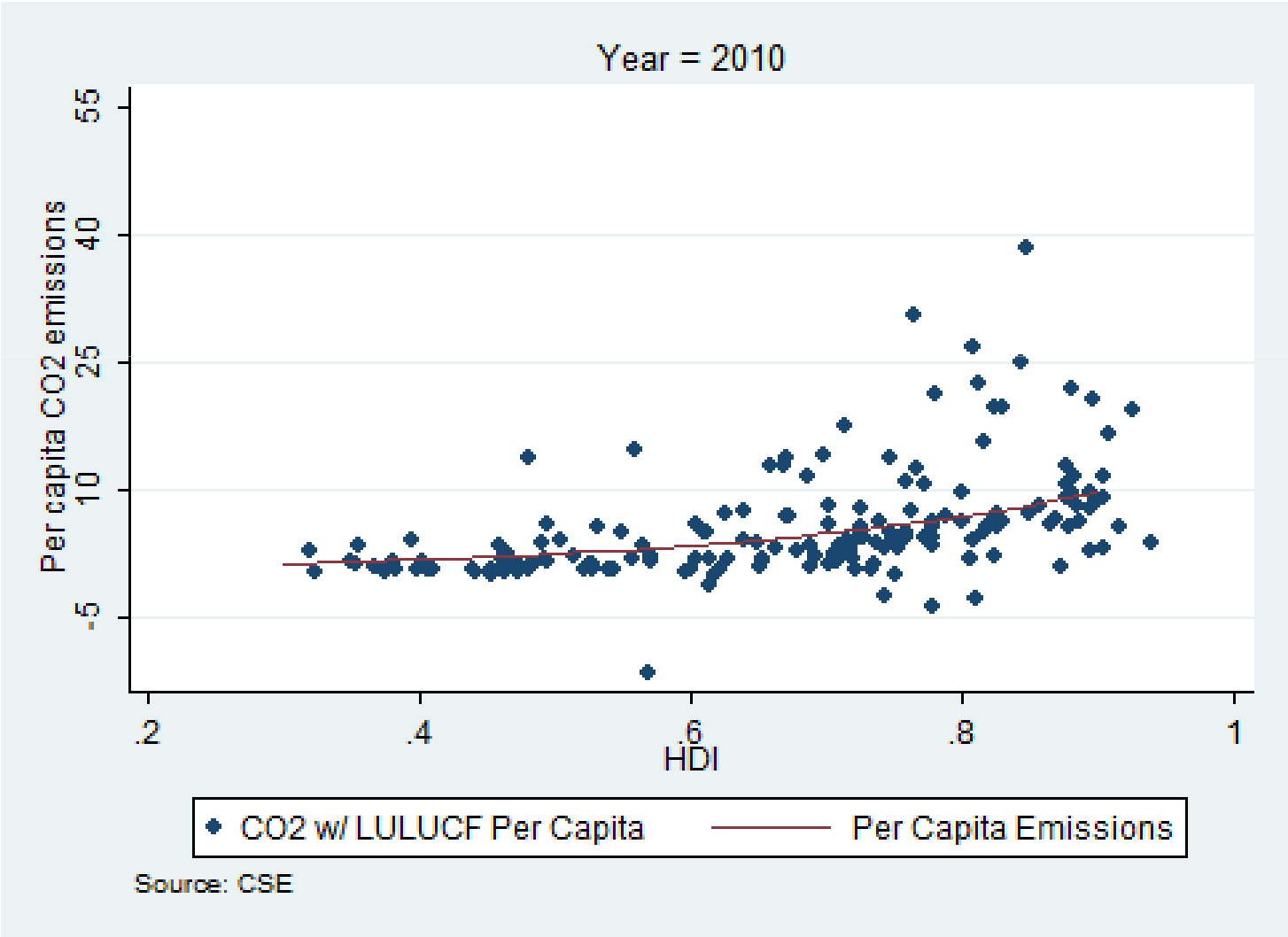
Per capita emissions v/s HDI – 2000



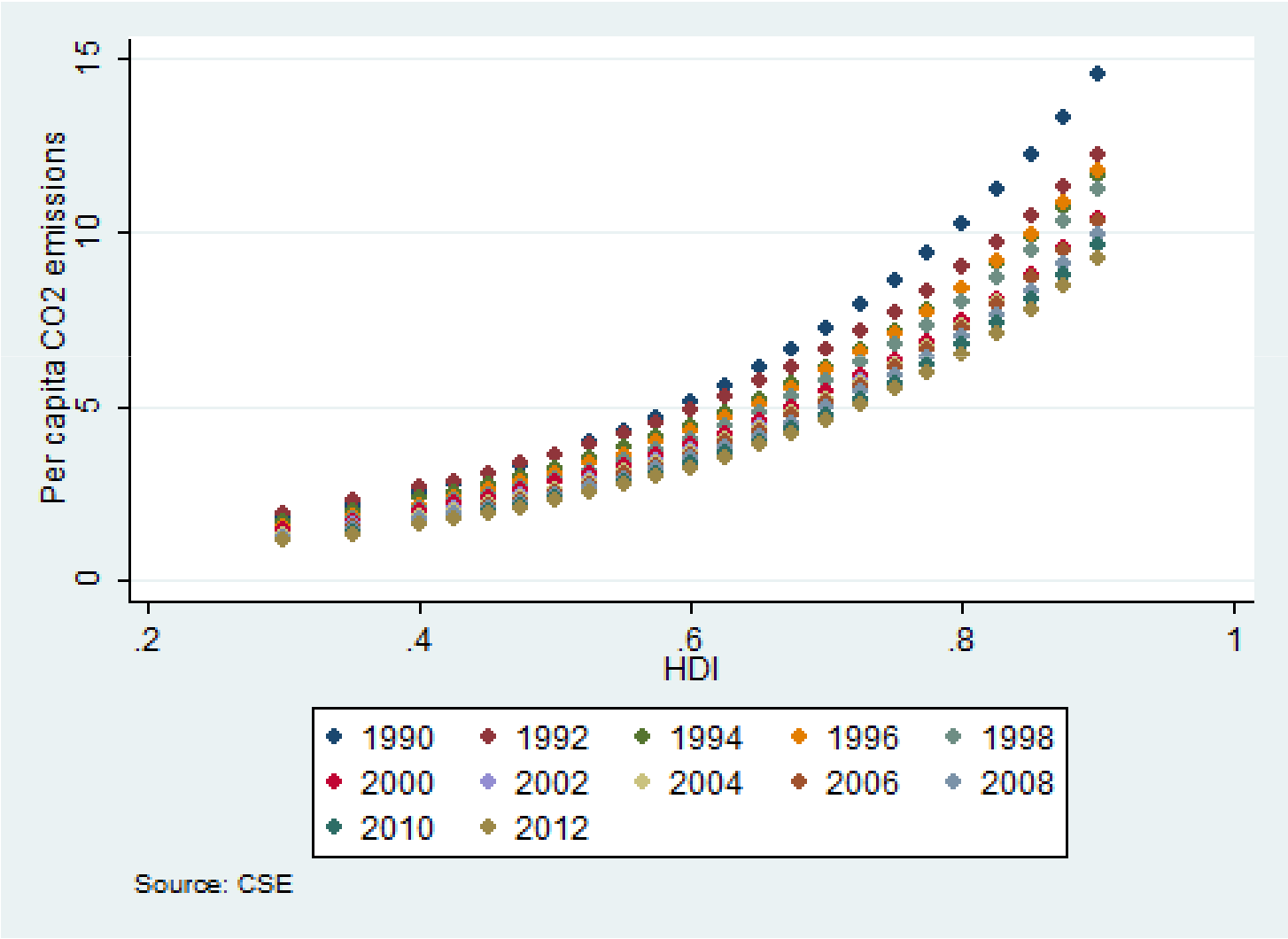
Per capita emissions v/s HDI – 2005



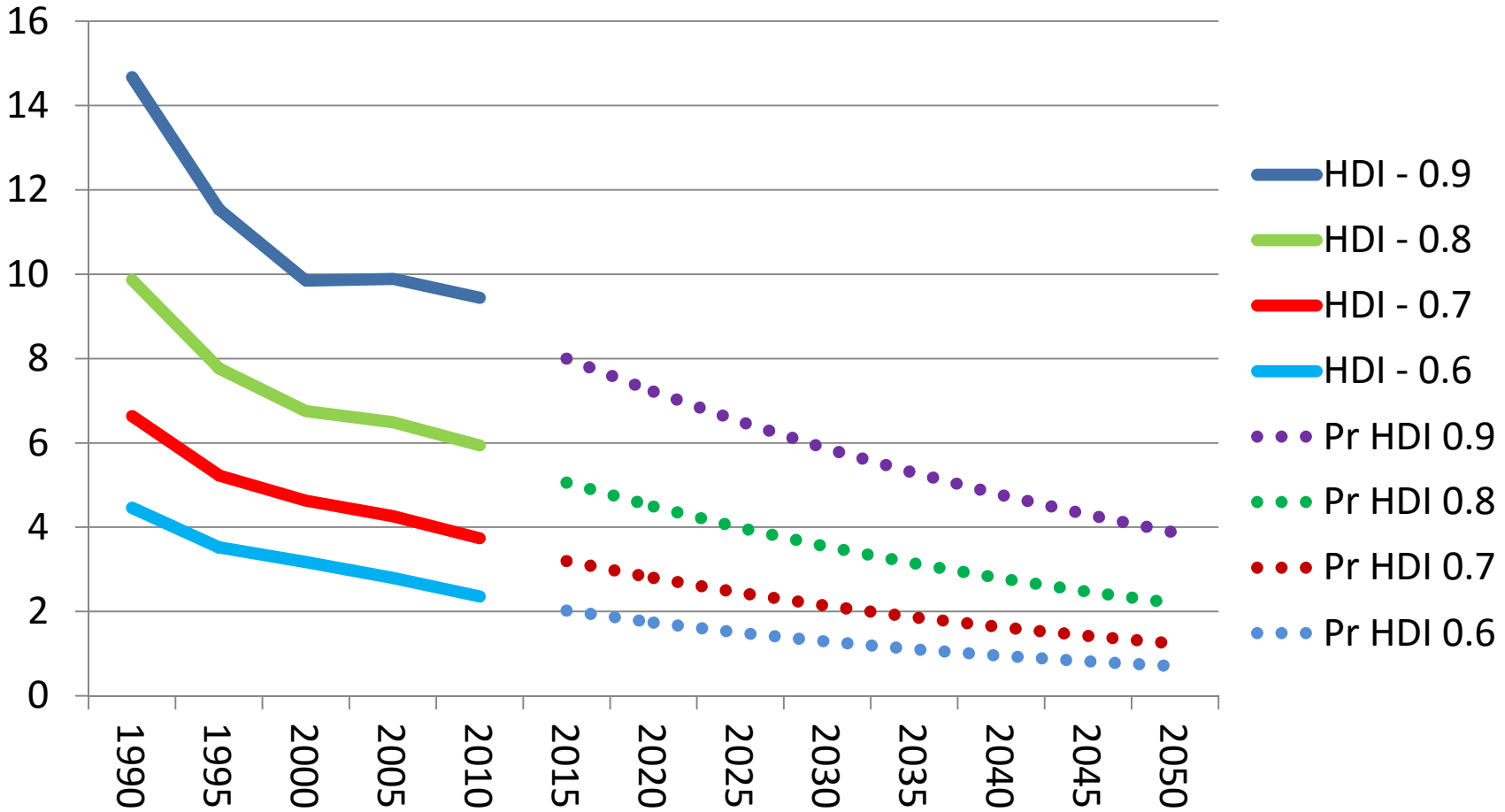
Per capita emissions v/s HDI – 2010



Exponential trend-lines showing relationship b/w Per capita and HDI for each year



Decreasing Per capita emissions required for given HDI over the years



RESULTS

Table 5: HDI 0.9 : Developing countries right over carbon budget to meet 0.9 HDI. Developed countries get remaining carbon budget (emissions reaches net zero in 2035, and go negative thereafter).

	Cumulative Emissions (GT CO_2)			Cumulative per capita on 1990 population (CO_2/year)		
	1850-2070	1990-2070	2012-2070	1850-2070	1990-2070	2012-2070
Global	3262.9	2021.2	1413.0	614.5	380.7	266.1
Non- Annex 1	2324.6	1853.4	1535.6	560.7	447.1	370.4
Annex 1	938.4	167.7	-122.6	806.1	144.1	-105.4
China	548.5	428.5	332.8	475.1	371.1	288.3
India	325.4	301.2	278.6	373.7	346.0	320.0
USA	234.6	41.9	-30.7	927.8	165.9	-121.3
BASIC	1016.5	813.7	666.3	464.4	371.8	304.4

0.9 HDI Scenario: Total CO2

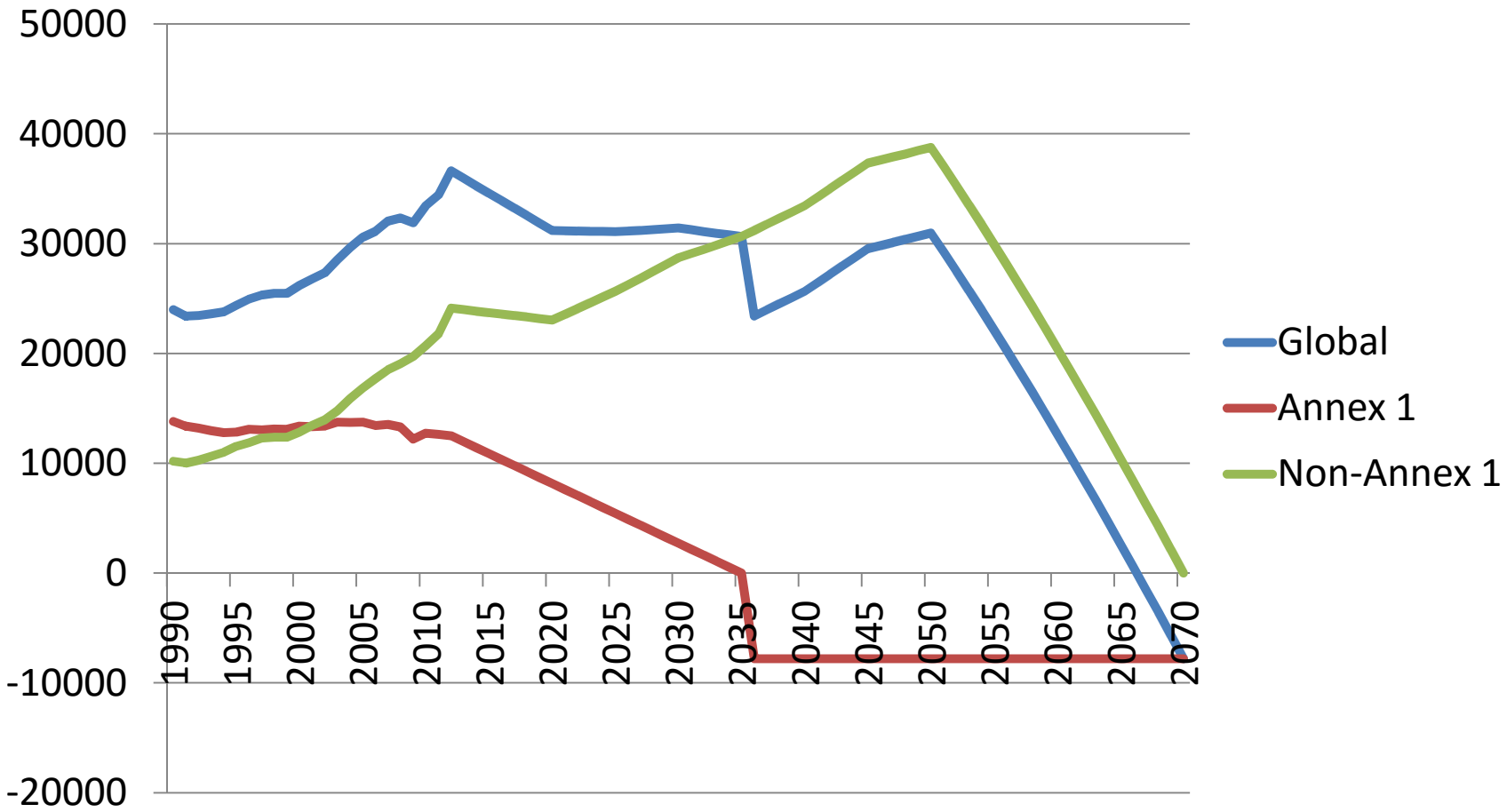
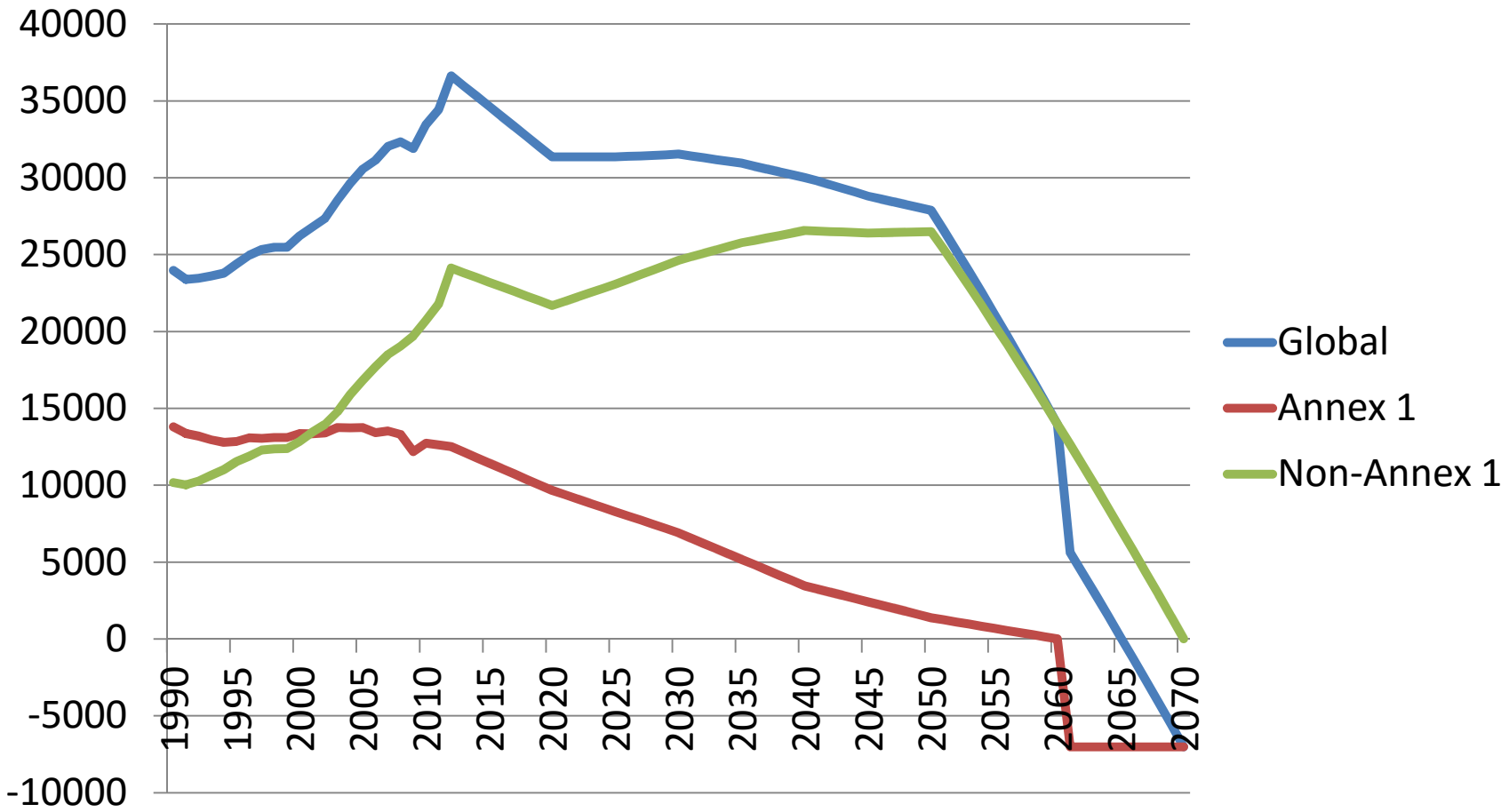


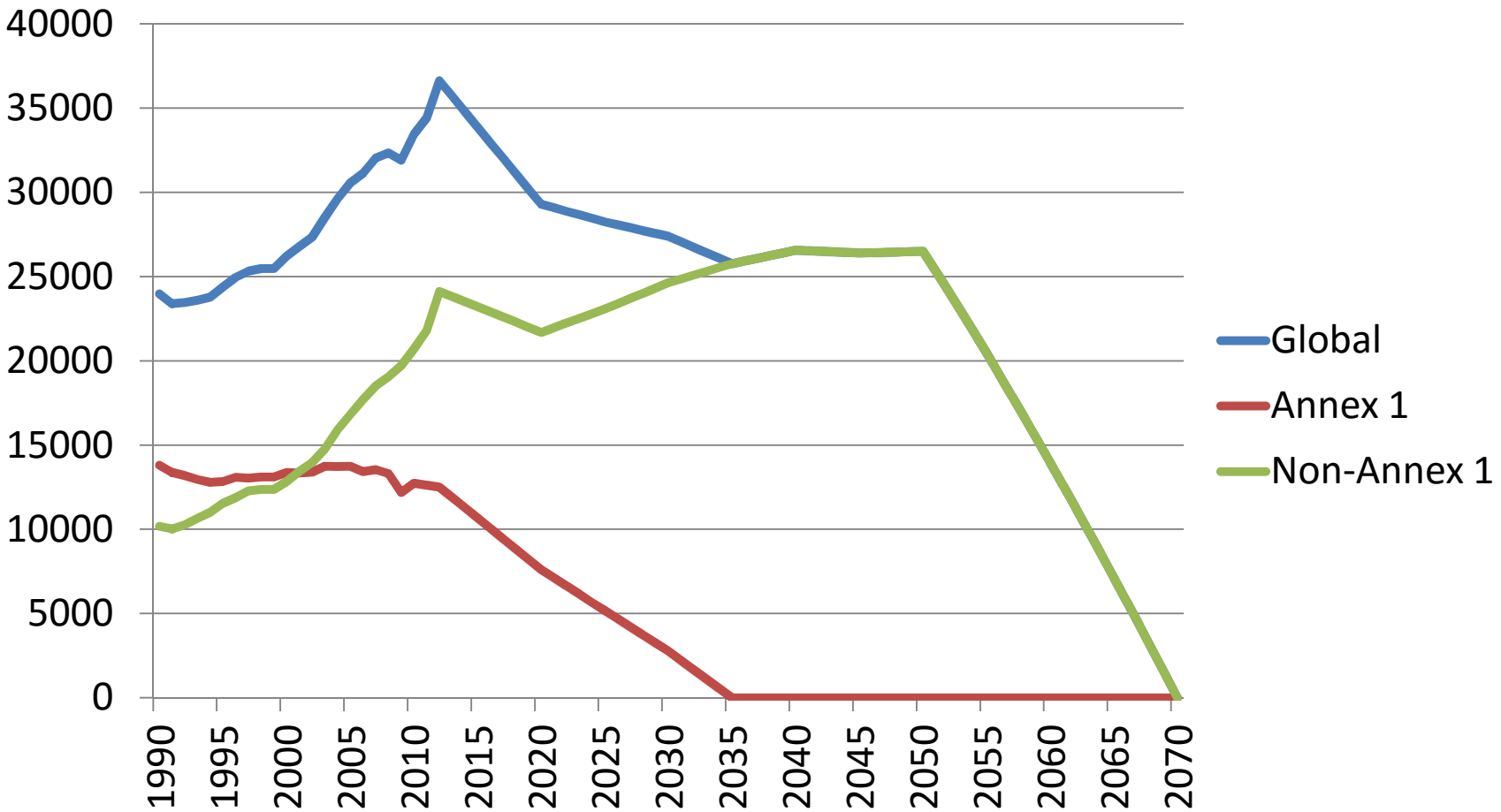
Table 6: HDI 0.8 : Developing countries right over carbon budget to meet 0.8 HDI. Developed countries get remaining carbon budget

	Cumulative Emissions (GT CO_2)			Cumulative per capita on 1990 population (CO_2/year)		
	1850-2070	1990-2070	2012-2070	1850-2070	1990-2070	2012-2070
Global	3262.9	2021.2	1413.0	614.5	380.7	266.1
Non- Annex 1	2011.5	1540.4	1222.6	485.2	371.6	294.9
Annex 1	1251.4	480.8	190.4	1075.0	413.0	163.5
China	491.0	371.0	275.3	425.2	321.3	238.5
India	265.9	241.7	219.1	305.4	277.6	251.7
USA	312.9	120.2	47.6	1237.3	475.4	188.2
BASIC	908.2	705.4	551.0	414.9	322.2	251.7

0.8 HDI Scenario (Annex 1 reach 90% below 1990 in 2050 & Net Zero in 2060) : Total CO_2



0.8 HDI Scenario (Annex 1 reach Net Zero Emissions in 2035) : Total CO_2



Conclusions

- “0.9 HDI” scenario results in just developing countries requiring equal to or more than the entire remaining carbon budget
- Only “0.8 HDI” scenario that seems to have
  - Some equity in terms of carbon budget used, post 1990
  - Realistic in terms of emissions reduction – net zero by 2035 for developed countries, or negative emissions if delay in reaching net zero
- While India has right to demand Carbon space HDI of 0.9, figure corresponding to 0.8 HDI (220 GT CO2) is the bare-minimum that India should agree to.
- But the development of Non-annex-1 countries will be significantly curtailed in this case – a heavy price for the profligate emissions of the Annex-1 countries.