

Global Carbon Budgets and Burden-Sharing in Mitigation

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Global Warming and Developing Nations

i) Necessity of Carbon Space for Poverty Alleviation & Development

ii) Need to check global warming – Most damaging impacts on the poor; Development will be compromised by unchecked global warming.

Equity based on Per Capita Flows

Per capita flows – Justified, useful measure.

BUT

Historical responsibility (an integrated measure) goes beyond flow

) Provides only a weaker argument to quantify the developed country emission reductions (What is wrong with contract and converge?)

i) Does not provide a route to simultaneously address the global environmental constraint – “Equitable access” while keeping global warming in check.

Equity based on Per Capita Stock

“Equitable access to global atmospheric space”
(From AWG-LCA text at Copenhagen)

Equity in the global commons.

Strengths

- i) Explicitly accounts for and sharpens the burden of historical responsibility – Linking historical responsibility to the global environmental constraint.
- ii) Makes a stronger case for financial flows and technology transfer from developed nations to ALL developing nations.
- iii) Provides a path to maintain the global budget constraint while maximising approach to ‘‘physical’’ equity.
- iv) Minimises the impact of spurious arguments (peaking years for all developing countries)

Carbon Budgets – Entitlements

50 Basis - Constant Population	Fair Share Based on 2009 Populations	Total Entitlements (GtC) 1850-2050	Actual Current Occupation 2009	Future Entitlements 2010-2050
	4.57%	28.90	95.71	-66.81
	7.21%	45.57	86.74	-41.17
Annex -I	6.88%	43.47	62.90	-19.43
	17.40%	109.95	8.66	101.29
	19.57%	123.64	33.09	90.55
	2.81%	17.78	2.88	14.90
Emerging Economies	12.23%	77.23	28.15	49.09
of the World	29.31%	185.19	13.88	171.31
	100.00%	631.73	332.00	2

The Physical Context of Historical Responsibility

Even worse than legal entitlements indicate -

i) Physical Over-occupation makes Equity only Partially Realisable in physical terms – Carbon space essential for development

ii) Even with very steep reductions by developed nations, more industrialised developing countries will be forced to undertake earlier mitigation efforts to protect their populations and the rest of the world, particularly other developing countries

iii) Countries with current low rates of industrialisation need

Recall Four Scenarios (I-IV) and two options (A,B)

Scenario I – Only equity is considered

Scenario II – Only equity and restriction based on per capita flow are considered

Scenario III – Only equity and the global carbon budget are considered

Scenario IV - Equity, the global carbon budget and the per capita flow are all considered.

Option A – Maximum allowed rate of growth slows down after 2020

Option B – Maximum allowed rate of growth keeps growing until 2050

A Drastic Scenario (100% reduction by Annex-I by 2020)

Drastic Cuts by Annex-I	Entitlements (GtC)	Allocation between 2010 and 2050 (GtC)
Annex-I	-127.40	14.14
India	101.28	68.08
China	90.54	75.87
Brazil	14.90	7.40
South Africa	0.80	0.41
Rest of the World	171.30	80.95

Comparing the Scenarios for the Same Option (A)

**1850 Basis, Option A,
(relative to 1990, 48% cuts by 2020 and 97% by 2050) (GtC)**

	Annex-I	India	China	Brazil	South Africa
entitlement	-127.41	101.29	90.55	14.90	0.80
scenario-I	52.58	70.28	95.45	15.00	2.07
scenario-II	51.81	69.95	94.56	14.89	1.55
scenario-III	50.18	40.17	79.52	12.82	1.53

Implications

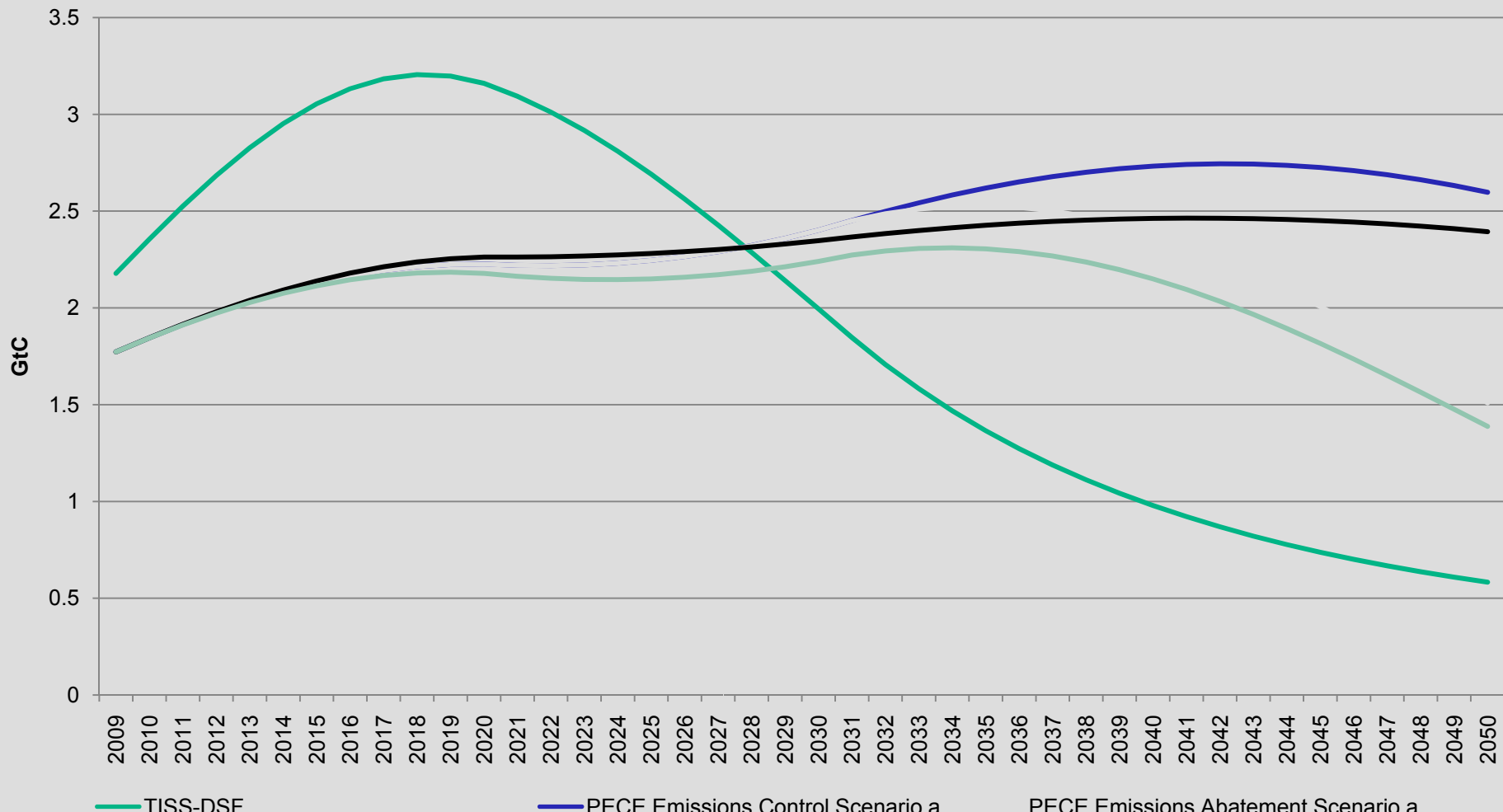
- Across all Scenarios – Annex I carbon space released more or less constant
- Main difference between scenarios – Relative distribution of carbon space between developing nations.
- India gains in Scenario IV since per capita constraint slows down the others
- Brazil loses in Sc. IV for the same reason.

Mitigation effort required by China

	Budget between 2010 and 2050
Model - 1850 Scenario-IVA	79.08
PECE Emissions Control Scenario a	98.92
PECE Emissions Abatement Scenario a	90.00
ERI Low Carbon Scenario b	94.74
ERI Enhanced Low Carbon Scenario b	84.78

Emission Trajectories for Different Scenarios (China)

Emission Trajectories for China



Comparing the two options for the same scenario (IV)

1850 Basis - Constant Population	Future Entitlements 2010-2050	Model Allocation (Scenario IV , Option A) 2010-2050 Based on cuts (from 1990 levels) of 48% by 2020 and 97% by 2050 by Annex-I	Model Allocation (Scenario IV, Option B) 2010-2050 Based on cuts (from 1990 levels) of 63% by 2020 and 99% by 2050 by Annex-I
USA	-66.81	18.41	14.54
EU	-41.17	14.38	11.35
Other Annex-I	-19.43	17.39	13.71
India	101.29	53.43	56.30
China	90.55	79.08	88.34
Brazil	14.90	5.86	5.74
South Africa	0.80	1.53	1.20
Other Emerging Economies	48.28	32.30	30.46
Rest of the World	171.31	75.81	75.79

Implications

- I) The carbon space released by Annex-I cuts distributed slightly differently in the two options
- II) Allowing RotW below fair share to grow steadily – the physical carbon space has to be shared by India with them.
(This result is indicative – It could have been taken from China & other EE)
- III) EE not affected because of their current high momentum of flow

Comparing the two options for the same scenario – higher cuts

1850 Basis - Constant Population	Future Entitlements 2010-2050	Model Allocations (Scenario IV, Option A) (2010-2050) Based on cuts (from 1990 levels) of 63% by 2020 and 99% cuts by 2050	Model Allocation (Scenario IV, Option B) (2010-2050) Based on cuts (from 1990 levels) of 63% by 2020 and 99% cuts by 2050
USA	-66.81	14.54	14.54
EU	-41.17	11.35	11.35
Other Annex-I	-19.43	13.71	13.71
India	101.29	57.39	62.83
China	90.55	79.18	77.63
Brazil	14.90	7.40	6.31
South Africa	0.80	1.20	1.20
Other Emerging Economies	48.28	33.72	29.03
Rest of the World	171.31	76.08	78.10
Total	299.72	294.57	294.57

Adding LULUCF to Historical Responsibility- Who Pays the Price?

	*Non- LUCF Only	**LUCF + Non-LUCF	Fair Share
	1850 Basis	1850 Basis	2009 Population Bas
USA	28.8%	23.9%	4
EU(27)	26.1%	20.9%	7
Russian Federation	8.0%	7.8%	2
Japan	4.0%	3.7%	1
Australia	1.1%	0.9%	0
Canada	2.2%	1.8%	0
Other Annex-I	3.6%	5.0%	2
China	10.0%	8.0%	19
India	2.6%	3.2%	17
Brazil	0.9%	4.4%	2
South Africa	1.1%	0.8%	0
Indonesia	0.6%	1.8%	3
Mexico	1.1%	1.9%	1
South Korea	0.9%	1.0%	0
Other FF	4.7%	5.8%	5

Who Pays the Price (Contd.)

Loss of carbon space to Brazil, Indonesia, Rest of the World compared to China, India and other large developing countries.

Annex-I cuts will remain as severe. So no extra carbon space is generated, relative to the case with only non-LUCF for historical responsibility.

Effect of Change of Base Year (from 1850 to 1970)(Sc. IV, A)

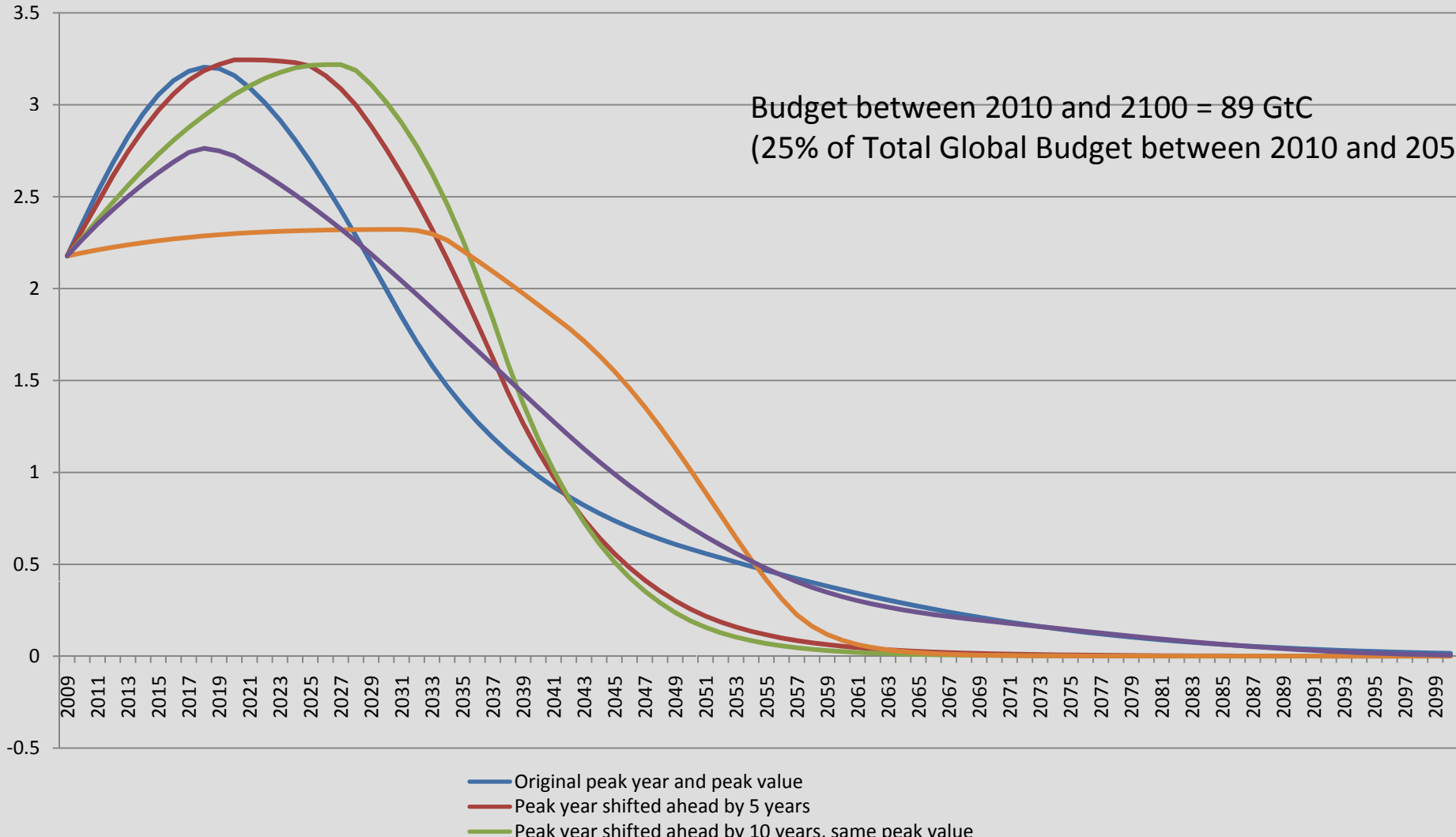
1850 basis			
	Future Allocation (2010-2050)		
	Entitlement	Lower Cuts	Higher Cuts
ex-I	-127.41	50.18	39.60
a	101.29	53.43	57.39
na	90.55	79.08	79.18
zil	14.90	5.86	7.40
th ca	0.80	1.53	1.20

1970 basis			
	Future Allocation (2010-2050)		
	Entitlement	Lower Cuts	Higher Cuts
	-100.43	50.18	39.60
	99.12	58.39	60.00
	78.92	71.87	71.00
	14.06	8.07	11.00
	0.43	1.53	1.20

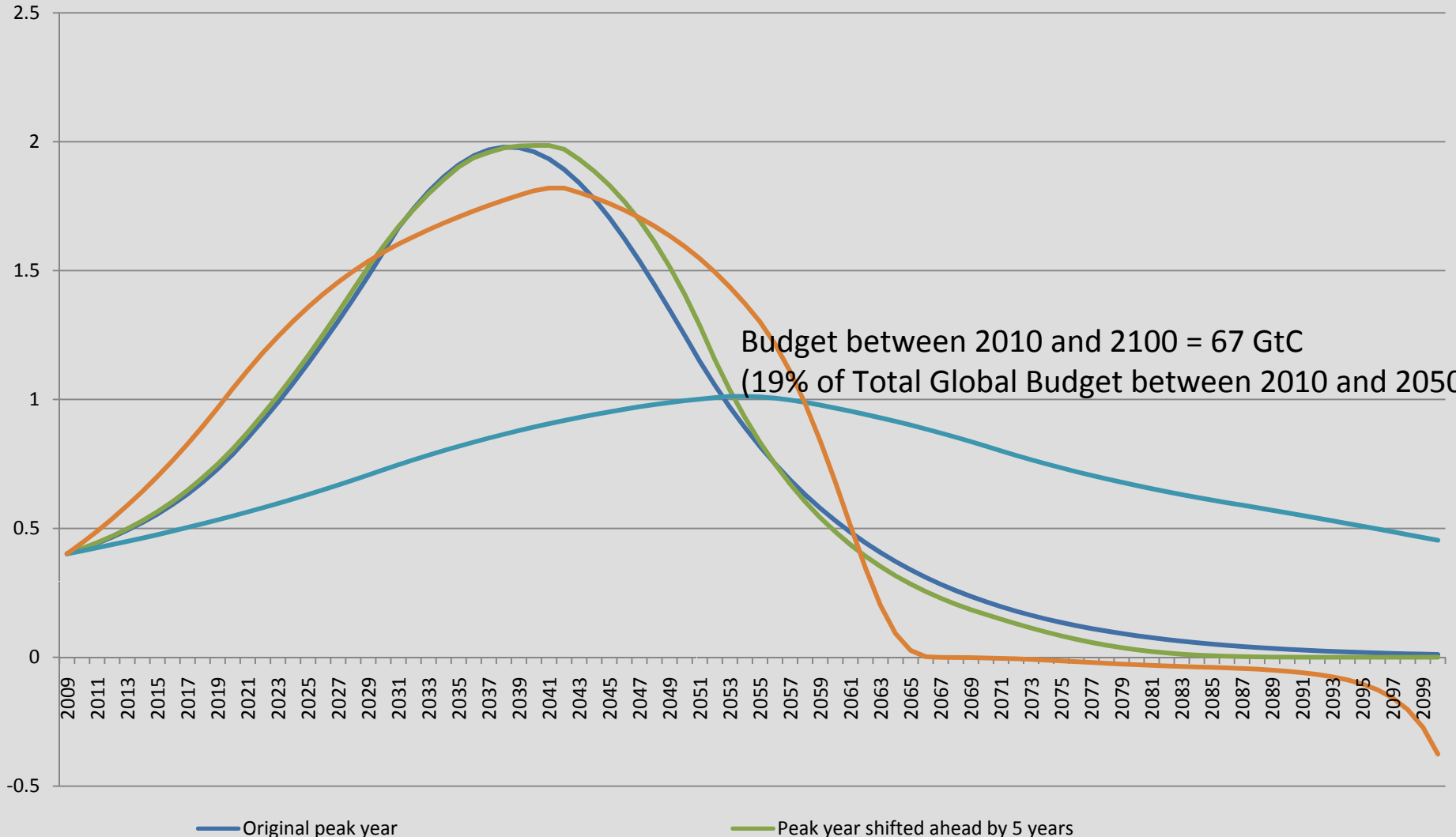
Effect of Change of Base Year

- Physical carbon space released by Annex-I cuts are identical
- Enables a somewhat different distribution of remaining carbon space among the developing countries.
- China obtains somewhat less physical space
 - but obtains close to legal entitlement !!

Emission Trajectories for the Same Budget (China)



Emissions Trajectories for the Same Budget (India)



Constant vs. Changing Population

1850 Basis, Scenario-IVA		
	Constant Population	Changing Population
Annex-I	50.18	50.18
India	53.43	59.27
China	79.08	57.96
Brazil	5.86	8.32
South Africa	1.53	1.53
RotW	75.81	79.88

Carbon Space and Developed Countries

- Developed country offers - Difference between 80% (below 1990 levels) and 95% in 2050 substantial. Requires also high intermediate year cuts. (The Angela Merkel offer at Copenhagen).
- US Academies Report for Congress – Claims 46.4 – 54.5 GtC for 2012-2050 for US alone.
- Perpetuating over-occupation of carbon space.

SUMMARY (MODEL)

- The carbon space/budget approach – an index to evaluate all mitigation proposals
- The emissions model (including dynamic and static models) - Use to study various mitigation proposals.
- Will be extended to an user-friendly version with a graphical interface – Code will then be available publicly.

SUMMARY

- Key to releasing carbon space for developing countries - massive reductions by developed countries immediately and steeply right through 2050.
- Over-occupation of carbon space by developed countries – source of distributional question for developing countries. Large dev. Countries have key role to play.
- Access to physical carbon space – Quantification of the demand of developing countries for recognition of their over-riding priority for poverty alleviation and development.
- Carbon Space Entitlement - Benchmark for financial transfers & tech. transfers.

Conclusions (contd.)

- Carbon budgets – Quantification of “common but differentiated responsibilities”
- Proximity to fair share & high per capita flows – possible index of respective capabilities (requires some further investigation)
- Change of base year to 1970 – Makes little difference to availability of carbon space for the majority of the world’s population – In fact there is some benefit
- Carbon Space deprivation for bulk of developing countries – What should be done?

Thank you

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