

Carbon and inequality: from Kyoto to Paris

**Trends in the global inequality of carbon
emissions (1998-2013) & prospects for an
equitable adaptation fund**

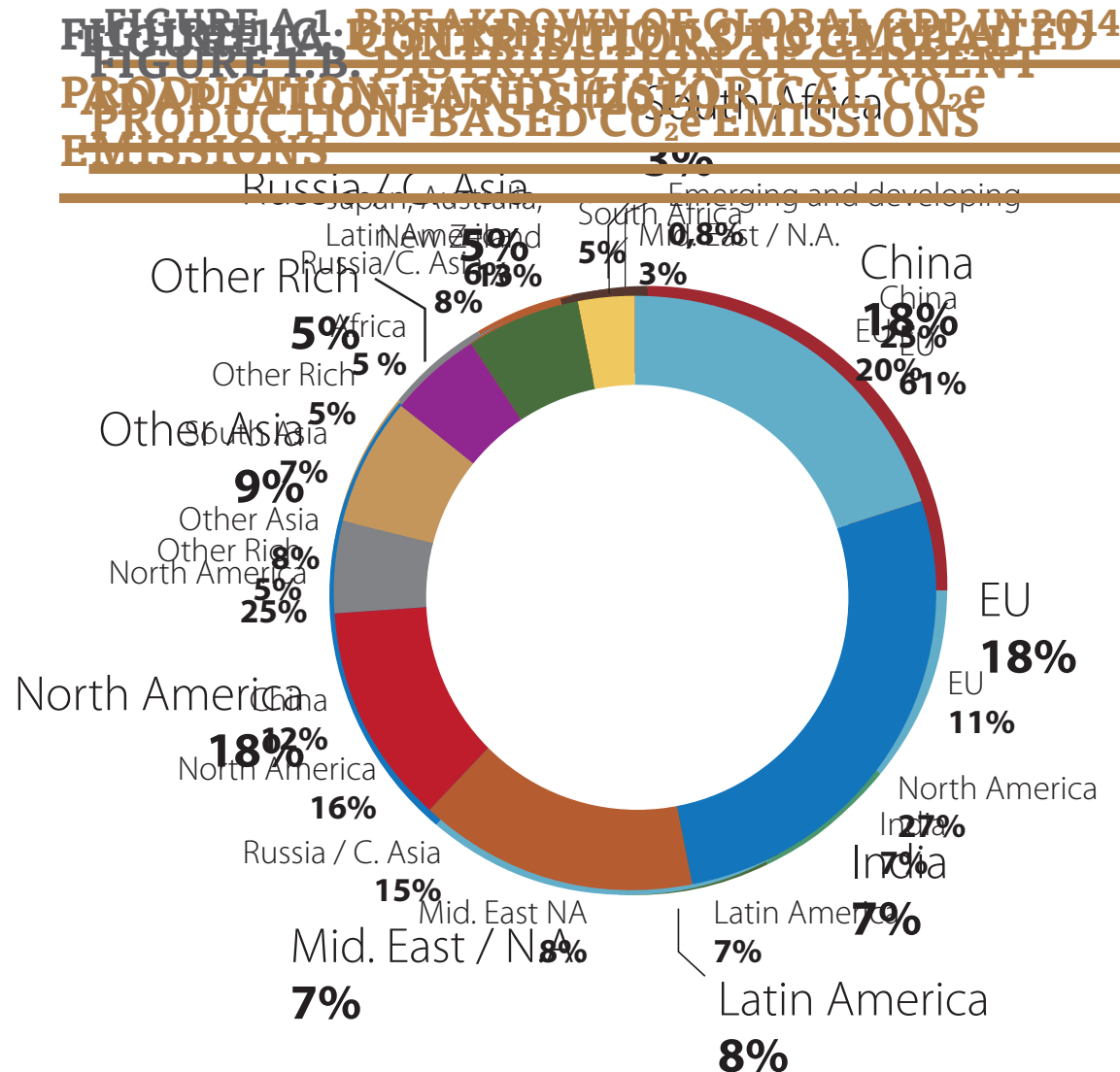
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Thomas Piketty, Paris School of Economics

3RD NOVEMBER, 2015

Climate adaptation funding: the gap

- Climate adaptation under funded: 5x less funds for adaptation than for mitigation.
- Equity logic beyond adaptation remains unclear. > half of funds from the EU.
- Breakdown does not correspond to historical emissions, nor to current emissions... nor to current GDP.



Our methodology

- **We use a world inequality dataset, with income information for different groups within 100+ countries.**

Milanovic and Lakner (2015) provide worldwide inequality data for nearly all countries, 10 deciles per country

- **We correct this dataset with specific top income data (top 1%), so as to better represent the top of the pyramid.**

Use World Top Income Database data to account for top incomes: 9 deciles + 90-99th + top 1%.

- **To each income group, we allocate individual CO₂ emissions using national-level consumption based-data and a simple elasticity model.**

Use GTAP-CICERO data for years 1998 and 2008 and construct estimate for years 2003 and 2013.

To allocate emissions to income groups, assume simple power law of income: i.e. $CO_2 = k \cdot Y^e$ (cf Chakravarty et al. 2009)

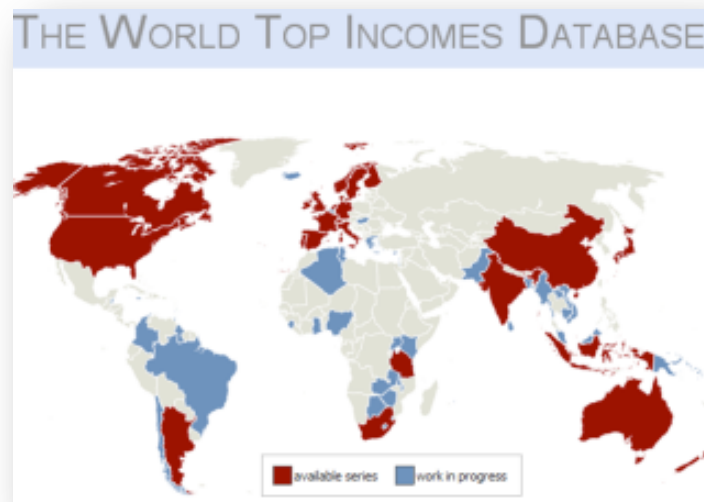
Test several elasticity values for robustness

Global Income Distribution

From the Fall of the Berlin Wall to the Great Recession

Christoph Lakner

Branko Milanovic



The importance of consumption-based emissions

CO2 emissions do not only stem from car engines and household heating appliances: individual indirectly emit CO2 via beef they eat, the smartphones they buy or services they purchase.

TABLE 3. CURRENT PER CAPITA GHG EMISSIONS - CONSUMPTION-BASED

	tCO ₂ e per person per year	% change with production	ratio to world average
World average	6.2	0	1
N. Americans	22.5	13	3.6
West. Europeans	13.1	41	2.1
Middle East	7.4	-8	1.2
Chinese	6	-25	1
Latino Americans	4.4	-15	0.7
S. Asians	2.2	-8	0.4
Africans	1.9	-21	0.3
Sustainable level	1.2	0	0.2

Source: authors' calculations based on (Peters and Andrew, 2015) and (WRI, 2015). Key: Western Europeans emit on average 13.1tCO₂e per year and per person, including consumption-based emissions. This figure is 41% higher than production base emissions and 2.1 times higher than world average. Note: data for 2013.

Study coverage

We cover about 90% of world GDP, population and CO₂e emissions

TABLE 2. GLOBAL GDP, POPULATION AND GHG COVERAGE (%)

Year	GDP	Population	CO ₂ e
1988	91.8	79.1	NA
1993	97.1	89.9	NA
1998	96.7	89.4	87.2
2003	96.1	89.6	87.1
2008	93.9	87.8	89.1
2013	93.6	87.2	88.1

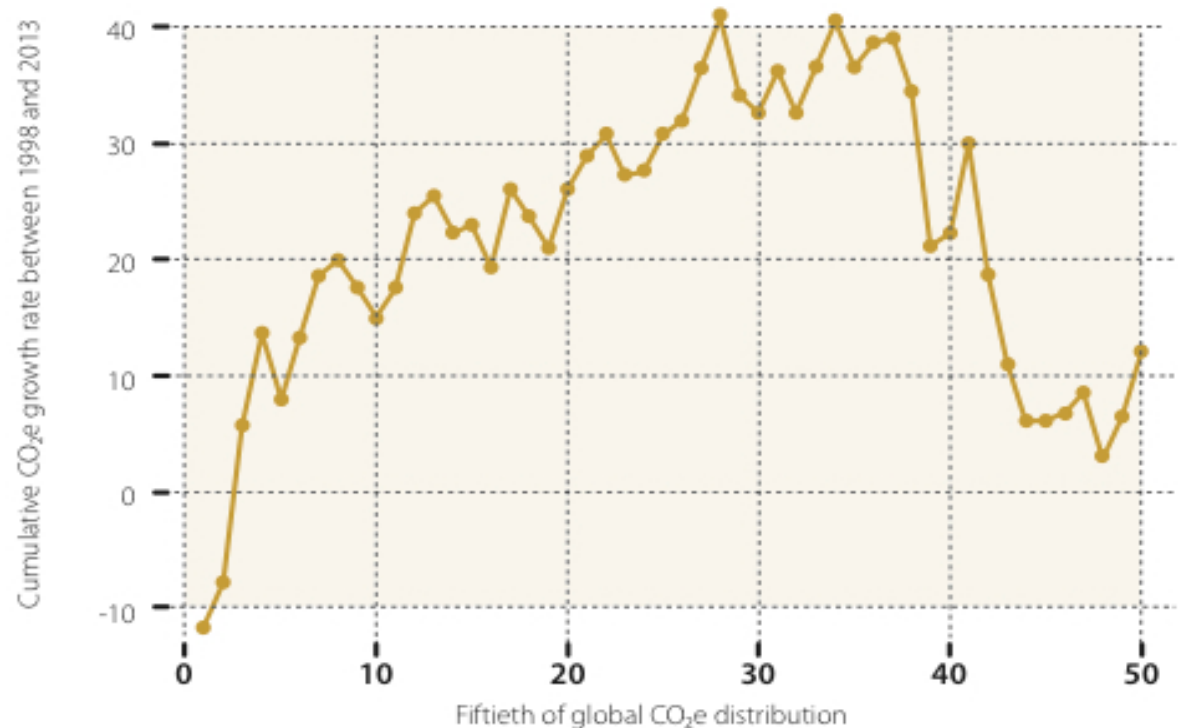
Source: authors. Key: The dataset covers 96.7% of world GDP in 1998, 89.4% of world population and 87.2% of world CO₂e emissions

Trends in the global inequality of carbon emissions (1998-2013)

An unequal rise in CO₂ emissions over the past 15 years

FIGURE E.2. HOW DID CO₂e EMISSIONS GROW FROM KYOTO TO PARIS FOR DIFFERENT GROUPS OF EMITTERS?

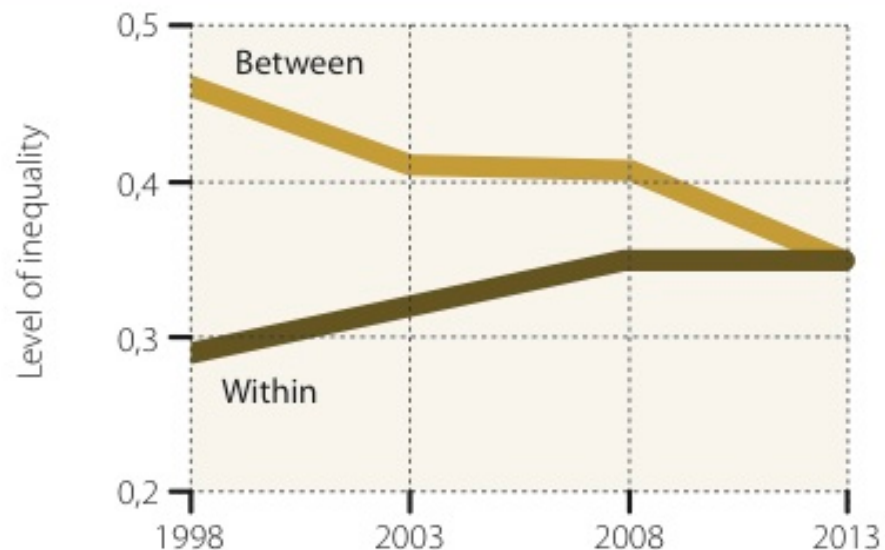
- Middle and upper classes of emerging countries on the rise since Kyoto: above 30% growth.
- Relative stagnation at the top and the bottom: around 10% growth.
- Emergence of global middle class: good from income perspective, worrying for the climate.



Within-country CO2 inequalities are increasingly important

FIGURE E.3. WORLD CO₂e EMISSIONS INEQUALITIES: WITHIN AND BETWEEN COUNTRY IMPORTANCE

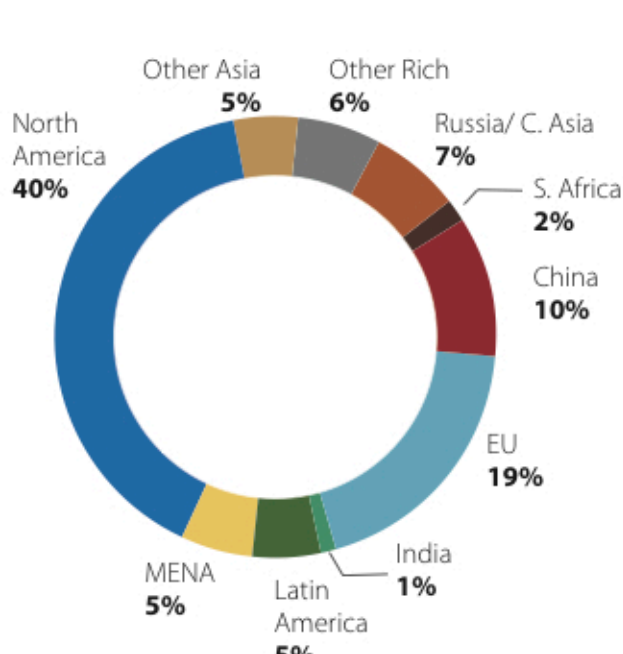
15 years ago, within-country inequality made up only 30% of global individual emissions inequality, today it explains 50%.



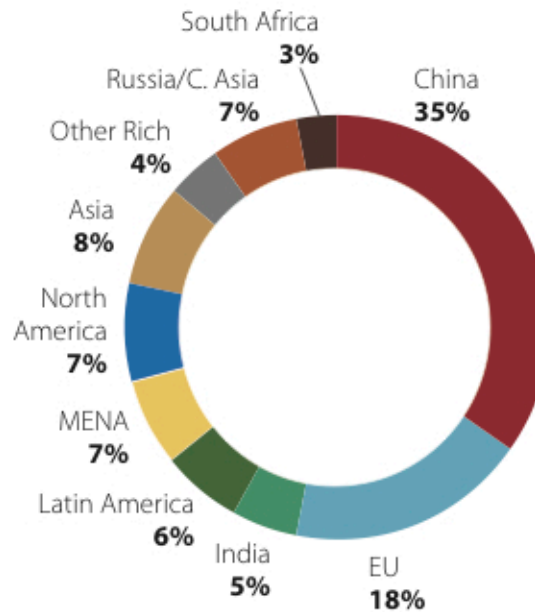
CO2 emissions remain highly concentrated

FIGURE E.1. BREAKDOWN OF TOP 10, MIDDLE 40 AND BOTTOM 50% CO₂e EMITTERS

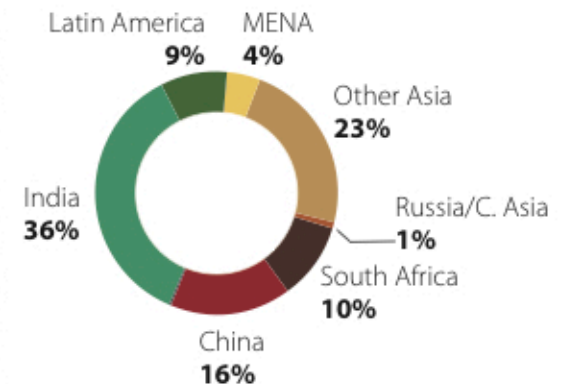
**Top 10% emitters:
45% of world emissions**



**Middle 40% emitters:
42% of world emissions**



**Bottom 50% emitters:
13% of world emissions**



- High concentration (top 10%=45%; bottom 50%=13%) but **less than income (top 10%=60%)**
- **Top 10% emitters on all continents:** 1/3 of them from developing & emerging countries.

Prospects for an equitable adaptation fund

Who should contribute to climate adaptation funding?

TABLE E.4. WHO SHOULD CONTRIBUTE TO CLIMATE ADAPTATION FUNDS?

Regions	Effort sharing according to all emissions (flat carbon tax) (%)	Progressive carbon tax strategies			Effort sharing according to a global tax on air tickets (%)
		Strategy 1	Strategy 2	Strategy 3	
		Effort sharing among all emitters above world average (%)	Effort sharing among top 10% emitters (above 2.3x world average) (%)	Effort sharing among top 1% emitters (above 9.1x world average) (%)	
North America	21.2	35.7	46.2	57.3	29.1
EU	16.4	20.0	15.6	14.8	21.9
China	21.5	15.1	11.6	5.7	13.6

Who should contribute to climate adaptation funding? (2)

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China	21.5	15.1	11.6	5.7	13.6
Russia/C. Asia	6.0	6.6	6.3	6.1	2.8
Middle East/N.A.	5.8	5.4	5.5	6.6	5.7
Latin America	5.9	4.3	4.1	1.9	7.0
S.S. Africa	3.1	1.5	1.5	1.1	1.1

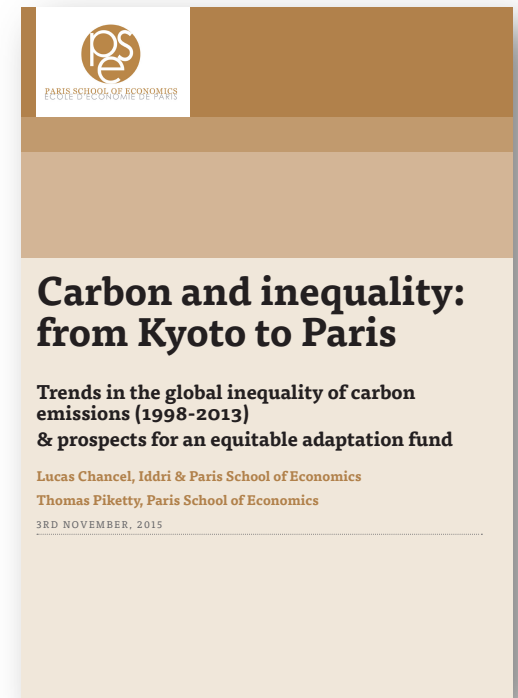
Who should contribute to climate adaptation funding? (3)

TABLE 10. IMPLEMENTATION VIA COUNTRY-LEVEL PROGRESSIVE INCOME TAXATION

Region	Top 1% emitters (Above 9.1x average)			
	Pop. share concerned	Mean income (€)	Marginal income tax (%)	Marginal income threshold (€)
North America	9.1%	130100	5.3	73218
EU	1.0%	171000	5.4	71922
China	1.0%	37300	13.9	32799
Russia/C.Asia	0.6%	168200	6.4	68377

Concluding remarks

- Adaptation is currently under funded and the equity logic behind its financing remains unclear.
- Rise in emissions of middle and upper income groups in emerging countries over past 15 years, relative stagnation of industrialized countries.
- Emissions remains highly concentrated. High individual emitters lie on all continents, 1/3 of top 10% global emitters come from emerging countries.
- In order to finance adaptation, we examine different progressive carbon taxation strategies. The fair combination of different strategies remains to be discussed. Ultimately, rich countries still should bear most of the efforts and increase their current contributions.



Full version online
piketty.pse.ens.fr/files/ChancelPiketty2015.pdf