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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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EXECUTIVE SUMMARY IN ENGLISH

This study presents evolutions in the global distribution of CO₂e emissions (CO₂ and other Green House Gases (GHG) between world individuals from 1998 and 2013 and examines different strategies to contribute to a global climate adaptation fund based on efforts shared among high emitters rather than high-income countries. To this end, we combine data on historical trends in per capita country-level emissions, within-country income inequality, as well as environmental input-output data (capturing consumption-based CO₂ emissions and other GHG gases) and a simple income-CO₂e elasticity model. Our data covers approximately 90% of world GDP, population and CO₂e emissions. Our results depend not only on within country inequalities, but also on changes in consumption-based CO₂e emission levels of countries.

We show that global CO₂e emissions inequalities between individuals decreased from Kyoto to Paris, due to the rise of top and mid income groups in developing countries and the relative stagnation of incomes and emissions of the majority of the population in industrialized economies. Income and CO₂e emissions inequalities however increased within countries over the period. Global CO₂e emissions remain highly concentrated today: top 10% emitters contribute to 45% of global emissions, while bottom 50% contribute to 13% of global emissions. Top 10% emitters live on all continents, with one third of them from emerging countries (Figure E.1).

Our estimations show that the top 1% richest Americans, Luxemburgers, Singaporeans, and Saudi Arabians are the highest individual emitters in the world, with annual per capita emissions

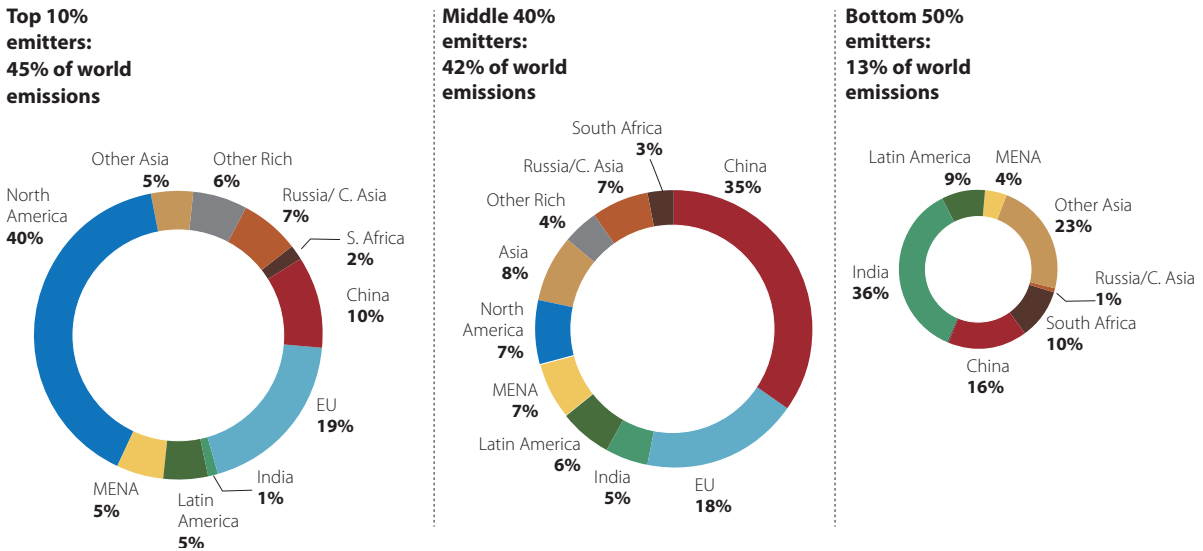
above 200tCO₂e. At the other end of the pyramid of emitters, lie the lowest income groups of Honduras, Mozambique, Rwanda and Malawi, with emissions two thousand times lower, at around 0.1tCO₂e per person and per year. In the middle of the world distribution of emitters (between 6 and 7tCO₂e per person and per year), lie groups such as the top 1% richest Tanzanians, the Chinese 7th income decile, the French second income decile or the third German income decile.

Middle and upper classes of emerging countries increased their CO₂e emissions more than any other group within the past 15 years. This led to a reduction in the global dispersion of CO₂e emissions—especially between the middle of the income distribution and the top (Figure E.2). However, the inequality of CO₂e emissions increased between the bottom of the distribution and the middle. While these trends, if continued, are positive from an income point of view (emergence of a global middle class), they constitute a real challenge for future global CO₂e emissions levels.

Our estimates also show that within-country inequality in CO₂e emissions matters more and more to explain the global dispersion of CO₂e emissions. In 1998, one third of global CO₂e emissions inequality was accounted for by inequality within countries. Today, within-country inequality makes up 50% of the global dispersion of CO₂e emissions (Figure E.3). It is then crucial to focus on high individual emitters rather than high emitting countries.

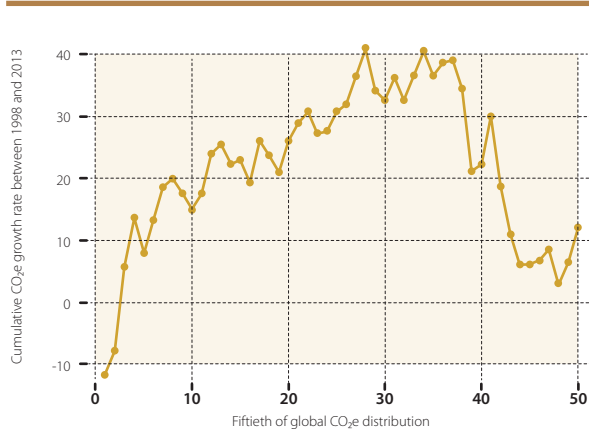
The new geography of global emitters calls for climate action in all countries. While developed and developing countries already engaged in mitigation efforts, contributions to climate adaptation funds remain almost entirely financed by developed nations, and for the most part by Europe

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



Source: authors. Key: Among the top 10% global emitters, 40% of CO₂e emissions are due to US citizens, 20% to the EU and 10% from China.

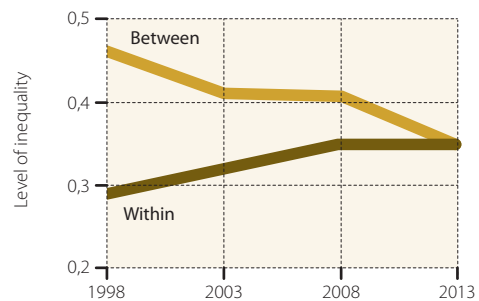
FIGURE E.2. HOW DID CO₂e EMISSIONS GROW FROM KYOTO TO PARIS FOR DIFFERENT GROUPS OF EMITTERS?



Source: authors. Key: the group representing the 2% lowest CO₂e emitters in the world, saw its per capita CO₂e emissions level decrease by 12% between 1998 and 2013.

(with more than half total contributions). If it is necessary to increase the volume of adaptation finance from developed countries, our study shows that upper income groups of emerging countries, who benefited from income growth and resulting CO₂e emissions growth over the past decades, could also participate in such funds. With the contributions of South Korea, Mexico or Columbia to the Green Climate Fund, emerging and developing

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



Source: authors. Key: in 2008, the within-country component of the Theil index was of 0.35 and the between-country component of 0.40, i.e. between-country inequalities contributed to 53% of total inequalities - as measured by the Theil index.

countries are committing to finance adaptation and broke the standard developed-developing countries divide which seemed to prevailed so far. However, their contributions remain symbolic at this stage (less than 1% of all global adaptation funds) and the equity logic behind adaptation funding remains unclear.

This report suggests novel strategies to increase global climate adaptation funding, in which

TABLE E.1. 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
Russia/C. Asia	6.0	6.6	6.3	6.1	2.8
Other Rich	4.6	5.8	4.5	3.8	3.8
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
India	7.2	1.0	0.7	0.0	2.9
Other Asia	8.3	4.7	4.1	2.7	12.1
S.S. Africa	3.1	1.5	1.5	1.1	1.1
World	100	100	100	100	100

Source: Authors. Air passenger data from World Bank (2015). Key: North Americans represent 46.2% of global emissions released by individuals who emit 2.3 times more than the global average. Individuals who emit more than 2.3 times average emissions (14.3 tCO₂e per year) belong to the top 10% emitters. Note: 27% of individuals emit more than world average emissions (Strategy 1). These estimations focus on consumption-based emissions.

individual CO₂e emissions (rather than national CO₂e or income averages) are the basis for contributions. In order to better align these contributions to the new distribution of high emitters, we first examine the implications of a global progressive carbon tax to raise €150 billion required annually for climate adaptation (Table E.1). In strategy 1, all emitters above world average emissions (i.e. all individuals emitting more than 6.2t per year) contribute to the scheme in proportion to their emissions in excess of this threshold. North Americans would contribute to 36% of the fund, vs. 20% for Europeans, 15% for China. In strategy 2, the effort is shared by all top 10% emitters in the world (i.e. all individuals emitting more than 2.3 times world average emissions), again in proportion to their emissions in excess of this threshold. North Americans would then pay 46% of the tax, vs. 16% for Europeans, 12% for China. In strategy 3, the effort is shared by all top 1% emitters in the world (i.e. all individuals emitting more than 9.1 times world

average emissions). North Americans would then contribute to 57% of efforts, vs. 15% for Europeans, 6% for China. In these new strategies to finance climate adaptation, the share of Europe would decrease in proportion, but increase in absolute terms. In strategy 3, the most favourable to Europeans, the volume of finance coming from Europe would reach €23 billion, more than three times its current contributions.

We also discuss possible implementations via country-level carbon and income taxes or via a generalized progressive tax on air tickets to finance the adaptation fund. A tax on air tickets has already been implemented in 9 countries and is currently used to finance development programs. Taxing all business class tickets at a rate of €180 and all economy class tickets at a rate of €20 would yield €150 billion required for climate adaptation every year. This latter solution might be easier to implement but less well targeted at top emitters.